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Percentage BoQ

Tender Inviting Authority: BHEL, TBG- SubContracting Department, Sector 16 A, Noida, UP

Name of Work: EXECUTION AND HANDING OVER OF SUPPLY & ETC WORKS OF 11KV DISTRIBUTION LINE AT 2X20MW RAHUGHAT HYDRO POWER PROJECT IN NEPAL.

Contract No: TBSM/RAHUGHAT/11kV LINE/ETC/TENDER/25-26 DATE: 09.04.2025

Name of the Bidder/ Bidding Firm / Company :	

PRICE SCHEDULE

(This BOQ template must not be modified/replaced by the bidder and the same should be uploaded after filling the relevent columns, else the bidder is liable to be rejected for this tender. Bidders are allowed to enter the Bidder Name and Values only)

NUMBER #	TEXT #	NUMBER #	TEXT #	NUMBER	NUMBER #
Sl. No.	Item Description	Quantity	Units	Estimated Rate in NPR.	TOTAL AMOUNT Without Taxes in NPR.
1	2	4	5	6	53
1	Total amount as per rates in BOQ (as per Annexure-I) for "EXECUTION AND HANDING OVER OF SUPPLY & ETC WORKS OF 11KV DISTRIBUTION LINE AT 2X20MW RAHUGHAT HYDRO POWER PROJECT IN NEPAL."- Including all taxes except VAT	1.000	Nos	34233399	34233399.00
Total in Figures					**34233399.00**
Quoted Rate in Figures			**Select**		**0.000**

CUSTOMER	**RAHUGANGA HYDRO POWER LIMITED (RGHPL)**
PROJECTS	**RAHUGHAT HYDRO ELECTRIC PROJECT (2X20MW)**

CONTENTS

SECTION 1:
SCOPE, PROJECT SPECIFIC TECHNICAL REQUIREMENTS & BILL OF QUANTITIES

1. Scope

1. This technical specification covers the requirement of detailed supply and erection of tubular poles in single pole support / double pole / four pole arrangement with complete 11KV line material such as 11kV disc insulators with fittings, 11KV pin insulators with pins, 11kv LA, 11kv Disconnectors, cross arms, pole top bracket, straight X arms, earthing material, guy sets with complete material with nuts & bolts washers, pole clamps and all other required lines accessories and belts & bracings, ACSR conductor, earth wire, fixing of insulator strings, stringing of conductor and earth wire etc and testing and commissioning of erected 11KV lines etc. complete in line with specification.

2. The technical specification also covers the requirements of design, manufacture, inspection including third party inspection and testing at manufacturer's works before supply, proper packing and providing services for installation, testing, carrying out of pre-commissioning checks and final commissioning of 11kV distribution line with accessories.

3. **The preliminary survey report for the 11kV distribution is enclosed herewith. However, bidders should visit the site/route to have a comprehensive understanding of the site requirements before submitting their offer.**

4. **Any other work/supply required for successful installation & commissioning of 11 KV Distribution line is in the scope of bidder.**

5. This section covers the specific technical requirements including quantities of 11kV distribution line with accessories. This constitutes **minimum technical parameters** for the above system as specified by the customer Section-2 (Equipment Specification under scope of Supplies) of this specification. The offered system shall also comply with the Section-3 (Project Details and General technical requirements for all equipment under the Project) of this specification.

6. It is not the intent to specify herein all the details of design, manufacturing and supply etc. The equipment and system shall conform in all respects to high standards of design, engineering and workmanship and shall be capable of performing the required duties in a manner acceptable to BHEL/ WAPCOS/RGHPL, who will interpret the meaning of drawings and specifications and shall be entitled to reject supply, which in his judgment is not in full accordance herewith.

7. 11KV distribution lines shall be running from 220kV Switchyard yard/Powerhouse to DAM & Colony area, which may require road crossing, major road, forest, vegetation, rivers, low-lying area, villages, agriculture fields as per site conditions. For details refer the report on route alignment survey for 11kv distribution line enclosed herewith.

8. Store area shall be allocated by BHEL/RGHPL, however, bidder shall construct open/ closed

store including office, if required as per their requirement. Storage in open/ closed store as per requirement shall be in bidder's scope including watch & ward.

9. The technical specification comprises of following sections:

Section-1	:	Scope, Project Specific Technical Requirements & Bill of Quantities
Section-2	:	Equipment Specification under scope of Supplies
Section-3	:	Project Details & General Technical Requirements (For All Equipment under the Project)

10. The following order of priority/ precedence shall be followed. In case of conflict between requirements specified in various documents, the more stringent one shall be followed. BHEL/WAPCOS/RGHPL concurrence shall, however, be obtained before taking a final decision in such matters.
    i). Statutory Regulations
    In particular, the latest version of the following statutory regulations, as applicable, shall be followed for system,
        o Nepal electricity act and National Electrical and Safety Code (NESC).
        o CEA regulations
        o Requirements of other statutory bodies as applicable, e.g. CEA.
    ii). Section-1
    iii). Section-2
    iv). Section-3
    v). Codes & Standards

11. In general, no deviation from the requirements specified in various clauses of this specification shall be allowed.

    The system is required for the following project:

Name of the Customer	:	RAHUGANGA HYDRO POWER LIMITED (RGHPL)
Name of Main Contractor	:	Bharat Heavy Electricals Limited
Name of the Project	:	RAHUGHAT HYDRO ELECTRIC PROJECT (2X20MW)

12. The commercial terms and conditions for supplies and services shall be as per notice inviting tender/ enquiry. Quoting the tender, shall deemed to have understood and complied all the technical requirements in line with technical specifications, drawings etc. in complete.

13. The term "Owner' appearing in this specification shall refer to ultimate customer, the term 'Purchaser" shall refer to BHEL and the term 'Contractor" shall refer to the successful Bidder.

2. Bill of Quantities

1. The schedule for quantities for 11kV Distribution Line is as per **Annexure- A (BOQ of SUPPLY) & Annexure- B for 11kV Distribution Line**, which includes schedule of supply as well as service also. BHEL reserves the right for overall contract value variation up to ±25% due to any reason at the same unit rates, terms & conditions during execution of contract.
2. The Payment of final & exact quantities for supply shall be as per approved quantities by BHEL/ WAPCOS/RGHPL.
3. The bidder must fill up all the details required for offered item/s. Instead of indicating "refer drawing, or as per IS/IEC", the exact value/s must be filled in.

3. Specific Technical Requirements

1. The specific technical requirements for 11kV distribution line with accessories is as follows,

Sl. No.	Description	Technical Parameters
a.	Nominal voltage class	11 kVrms
b.	Maximum System voltage	12 kV±
C.	Impulse withstand voltage (Dry & Wet)	±75 kVp
d.	1min Power frequency with stand voltage(wet)	28kV(rms)
e.	Minimum creepage distance	320 mm
f.	Temperature rise As per IS:9920	As per IS:9920

4. Codes & Standards

1. 11kV distribution line with accessories shall comply with the requirements of latest revisions of following standards issued by BIS (Bureau of Indian Standards)/ equivalent international standards but not limited to the following,

IS 2713 (Pt-I & III): 1980	The tubular steel poles
IS:731-1971	Porcelain Insulators for Overhead Power Lines with a Nominal Voltage greater than 1000V
IS 2486 (Pt.I): 1971 & IS 2486 (Pt.II): 1974	Metal Fittings of Insulators for Overhead Power Lines With Nominal Voltage greater than 1000 V – Specification
IS 3043: 1987	Code of practice for earthing
IS 2141:1979, IS 4826: 1979 & IS 6594: 1974	Hot dip galvanized stay strand
IS 5561	Electric power connectors
IS 2551: 1982	Danger notice plates
IS 9511: 1980	Earth knobs for neutral conductors
IS 280: 1978 & IS 7887: 1975	Mild Steel Wire for general engineering purposes
IS 398 (Pt. I & II): 1996	Aluminium Conductors for Overhead Transmission Purposes

2. In case of imported equipment, standards of the country of origin shall be applicable if these standards are equivalent or stringent than the applicable Indian standards.
3. The equipment shall also conform to the provisions of Indian Electricity rules and other statutory regulations currently in force in the country.
4. In case Indian standards are not available for any equipment, standards issued by IEC/ BSNDE/ IEEE/ NEMA or equivalent agency shall be applicable.

5. ERECTION COMMISSIONING AND TESTING

1. The bidder shall give the offer for Erection, Testing & Commissioning of the complete 11kv distribution lines at Site.
2. Contractor shall arrange all machinery tools & tackles, instruments and consumables required for erection, commissioning and testing of the system.
3. **The foundation of poles shall be constructed in accordance with the enclosed "Foundation Design of 11kV Pole Structure." If foundation area of any poles includes any slopes or depressions, the necessary filling/compaction shall be carried out by the contractor.**
4. Earthing of all electrical equipment as per requirements.
5. Contractor shall ensure that sufficient quantity of commissioning spares is made available for timely completion of commissioning of the system. The contractor shall furnish a list of Commissioning spares that will be brought by him. The unused commissioning spares shall

be returnable to the contractor.

6. Bidder shall depute its qualified testing engineer at site for successful testing and commissioning of 11kV distribution system.
7. **If any trees or vegetation are present along the route identified in the preliminary survey of the 11kV distribution line, their cutting/removal shall be the responsibility of the bidder**.

6. Drawings / Documents required for Engineering Manufacturing Clearance

1. Drawings/ documents detailed as detailed below shall be used for providing technical clearance for manufacturing of 11kV distribution line & its accessories which may be used for engineering delay analysis, if applicable for respective group.

1.	11kV distribution line- GA Drawing, GTP & BOM for main supply items
2.	11kV distribution line- Foundation Drawing and other details for site work
3.	11kV distribution line- Type test report for applicable supply items
4.	11kV distribution line- Quality Assurance Plan

2. The technical clearance for manufacturing shall be issued item wise subject to condition of approval of drawing/ documents in category-I (approval without any comments)/ category-II (approval with comments) from BHEL/ WAPCOS/RGHPL. In case drawing/ document are not duly stamped in category-1/ category-2 by WAPCOS/RGHPL, BHEL stamp/ confirmation shall be treated final to proceed further.
3. Date of Submission of drawings/ documents shall be counted only from the date of submission of reasonably correct drawings/ documents.
4. The successful bidder shall have to extend all possible support such as timely submission/ re-submission of drawings, visit to end customer to facilitate documents approval without any commercial implications to BHEL. Acceptance of bidder's documents shall be subject to end customer/ WAPCOS approval.

7. Type Testing

1. **Bidder shall ensure that materials of 11kV distribution line being procured shall have valid type test certificates as specified in IS/ IEC standards (amended up to date) at any independent laboratory/ NABL accredited laboratory for applicable items.**

2. Bidder shall submit valid type test reports (as per relevant IEC/IS standard) for the tests carried out within last 10 years from the date of techno commercial bid opening of this tender. The reports should have been conducted on identical or similar equipment/components to those offered. In case type test reports are more than 10 years old (from the date of techno commercial bid opening) or the reports of type tests are found to be technically unacceptable, the type test shall be conducted by the vendor without cost and delivery implication to BHEL.

3. Further, in case, any of type tests have not been conducted on the offered design or there has been a change in the design after the type tests, the requisite tests shall be conducted by bidder on the offered design by bidder without any commercial implication to BHEL.

8. Quality Plan

1. The successful bidder shall submit Quality Assurance Plan for 11kV distribution line for applicable materials with in-process inspection methods, tests, records, etc. for BHEL/WAPCOS/RGHPL approval. Customer hold points will also be included in the plan, which shall be mutually agreed by BHEL/WAPCOS/RGHPL.
2. In case bidder has reference, Quality Assurance Plan agreed with BHEL/WAPCOS/RGHPL., same shall be submitted for specific project to BHEL/WAPCOS/RGHPL approval. There shall be no commercial implication to BHEL/WAPCOS/RGHPL on account of Quality Plan approval.
3. Superior quality control system shall be adopted to assure high product quality. Raw materials of the best commercial grade quality and high reliability shall be used in the manufacture items. All materials shall be procured, manufactured, inspected and tested by vendor/ sub-vendor as per approved quality plan. The supplier shall perform all tests necessary to ensure that the material and workmanship conform to the relevant standards and comply with the requirements of the specification. Charges for all tests shall be deemed to be included in bidder's scope.

9. Inspection & Testing

1. 11kV distribution line & its accessories shall be subject to inspection by BHEL/WAPCOS/RGHPL or authorized representative at bidder/ manufacturers' works. Hence, Bidder shall furnish all necessary information concerning the supply to BHEL/WAPCOS/RGHPL.
2. The inspector shall have free access to the manufacturer's/ supplier's works for the purpose of inspecting the process of manufacture in all its stages and he will have the power to reject any material, which appears to him to be of unsuitable description or of unsatisfactory quality.
3. Bidder shall give at least 2 weeks' advance notice to BHEL/WAPCOS/RGHPL, regarding the date of testing to enable him or his representative to witness the tests. All the tests must be done as per the approved QAP (If applicable).

10. Packing and Dispatch

1. 11kV distribution line & its accessories shall be properly packed for selected mode of transportation i.e. sea, rail and road in such a manner that it is protected against the climatic conditions and for any damage during transportation, transit and storage. Crates/cases shall have skid bottoms for handling. Special notations such as 'Fragile', 'This side up', 'Weight', 'Owner's particulars\ 'PO nos.' etc., shall be clearly marked on the package together with other details as per purchase order.
2. The item/ materials may be stored outdoors for long periods before installation. The packing

should also be suitable for outdoor storage areas with heavy rains/ high ambient temperature unless otherwise agreed and hence, Packing shall be suitable for long storage (minimum 1 year).

11. List of Documents/ Drawings

Following drawing/ documents are attached for information purpose,

1. 11kV Distribution Line- Route Survey Drawing.
2. Key Erection Diagram for Single circuit & Double Circuit poles.
3. Foundation design of poles
4. Angle point schedule of 11KV OHL from powerhouse to DAM & colony area.
5. Report on route alignment survey for 11kv distribution line

ANNEXURE-A

11kV DISTRIBUTION LINES FOR RAGHUGHAT HYDRO POWER PROJECT IN NEPAL			
Bill of Quantities- SUPPLY			
S.N.	**Item Description**	**Qty**	**Unit**
A	**Steel Pole and Accessories**		
1	Supply of Steel tubular pole swagged type confirming to IS 2713		
1a	Supply of 410 SP-55 11m Length Swagged Pole for S/C OHL	175	Nos
1b	Supply of 410 SP-72 13m Length Swagged Pole for D/C OHL	40	Nos
1c	Supply of 410 SP-76 14.5m Length Swagged pole for long span	4	Nos
2	Single pole V type cross arm		
A	Single Circuit Line		
2a	Supply of Suspension pole V type cross arm (1 Nos. MS channel 100x50-1450 long with back cleat 75x40-350long) along with pole top bracket including 2 Nos. M16X250 bolt & nut (structural steel to IS 808:2021)	67	Sets
2b	Supply of Tension pole V type cross arm (2 Nos MS channel 100x50-1450 long in one set) along with pole top bracket (to be fitted with pin insulator + both side strain insulator) including 4 Nos. M16X250 bolt & nut.	46	Sets
B	Double Circuit Line		
2c	Supply of Suspension pole V type cross arm (1Nos. MS channel 100x50-1450 long with back cleat 75x40-350long) including 6 Nos. M16X250 bolt & nut	36	Sets
2d	Supply of Tension pole V type cross arm (2 Nos MS channel 100x50-1450 long in one set) to be fitted with pin insulator + both side strain insulator including 6 Nos. M16X250 bolt & nut	12	Sets
3	Double pole cross arm and bracings		
3a	Supply of 2.6m length (MS channel 100x50mm) double pole cross arm for 1.5m pole apart for 30d-90d deviation	45	Sets
3a(i)	Supply of 1.7m length belting angle 60x60x6mm	74	Sets
3a(ii)	Supply of 3.0m length bracing angle 60x60x6mm	74	Sets
3b	Supply of 2.6m length (MS channel 100x50mm) double pole cross arm for 2.4m pole apart for **'dead end' double pole 11**kV OHL structure	2	Sets
3b(i)	Supply of 2.6m length belting angle 60x60x6mm	4	Sets
3b(ii)	Supply of 3.5m length bracing angle 60x60x6mm	4	Sets
3c	Supply of 2.6m length (MS channel 100x50mm) double pole cross arm for 2.4m pole apart for **'dead end' four pole** 11kV OHL structure	8	Sets
3c(i)	Supply of 2.6m length belting angle 60x60x6mm for 'dead end' four pole	16	Sets
3c(ii)	Supply of 3.5m length bracing angle 60x60x6mm for 'dead end' four pole	16	Sets
3d	Supply of 6.0m length (MS channel 150x75mm) double pole cross arm for 3.0m pole apart for **'long span' four pole**	4	Sets
3d(i)	Supply of 3.2m length belting angle 75x75x6mm	8	Sets
3d(ii)	Supply of 5.0m length bracing angle 75x75x6mm	8	Sets
B	**Conductor and Hardware**		
4	Supply of ACSR Conductor Dog	34000	Meter
5	Supply of Mid Span Compression Joints c/w steel inner sleeve suitable for ACSR dog	68	Sets
6	**Lighting Arrester & disconnecting Switch**		
6a	Supply of Set of 3 phase **Air Break Disconnecting Switch-11kV, 400A,** along with structure,hardware as required to be fitted on double pole MS channel	4	Sets
6b	Supply of Set of 3 phase **Lightening Arrestor LA-11kV, 10kA** along with structure, hardware as required to be fitted on double pole MS channel.	4	Sets
6c	For above LA & DS Supply of LA & DS fittings, 2.6m length (MS channel 100x50mm) double pole cross arm for 2.4m pole apart for 'dead end' double pole 11kV OHL	4	Sets
7	Supply of 11kV, 5 KN Pin Insulators complete with Steel Pin etc. having creepage distance of min 320mm	920	Nos
8	Supply of Aluminium Binding wire 3.66mm for above Pin insulators	2600	Meter
9	Supply of 11kV, 70 KN Polymer, Ball & Socket Type Strain Insulator having creepage distance of 320mm.	632	Sets
10	Supply of PG Clamp suitable for ACSR dog, 3-Bolt Type	660	Nos

11	Supply of 11kV, 70 KN Single Tension assembly complete with all necessary attachments i.e. D-Shackle, Ball Link, Socket eye, socket tongue and 4-Bolt Pistol Grip Tension Clamp 70kN suitable for ACSR dog	660	Sets
12	Supply of Vibration Dampers, Stockbridge type suitable for ACSR dog.	1200	Nos
13	Supply of Holding Clamp for ADSS	460	Nos.
C	**Miscellaneous Pole Accessories**		
14	Supply of Steel (Stay) Guy wire of size 7/3.15mm, Grade 1100 to IS: 2141:2000 breaking strength 53.5 kN	4300	Meter
15	Supply of Stay Rod M20 x 2400mm complete with Bow and thimble etc. with steel plate 150 x 150 x 6mm COMPLETE WITH STAY INSULATORS	275	Sets
16	Supply of Guy Grip for 7/3.15mm Stay wire, Grade 1100 to IS:2141:2000	275	Nos
17	Supply of Standard size Danger plate suitable for 11kV OHL pole assembly	180	Nos
18	Supply of Pole and Line number Plate suitable for 11kV OHL pole assembly	180	Nos
19	Supply of 165mm dia anti climbing device	219	Nos.
20	Supply of Localised earthing pit for every 5th pole shall be provided with pipe type / strip type set as below		
20a	Supply of Earthing set Pipe Type, 40 mm diameter, 2 metre long, class B, GI pipe with hardware as required.	15	Nos
20b	Supply of Strip earthing set 40 mm strip 5mm thick 10.0m long with hardware as required.	45	Nos

NOTE:

1. The bidder shall include all related items, consumables, and hardware necessary for the safe and satisfactory operation of the complete 11kv distribution lines, even if not explicitly mentioned in the above BOQ, while quoting in price bid.

		ANNEXURE-B	
11kV DISTRIBUTION LINES FOR RAGHUGHAT HYDRO POWER PROJECT IN NEPAL			
Bill of Quantities- ETC			
S.N.	**Item Description**	**Qty**	**Unit**
A	**Steel Pole and Accessories**		
1	Steel tubular pole swagged type confirming to IS 2713		
1a	ETC of 410 SP-55 11m Length Swagged Pole for S/C OHL (includes excavation, refilling & required compaction)	175	Nos
1b	ETC of 410 SP-72 13m Length Swagged Pole for D/C OHL (includes excavation, refilling & required compaction)	40	Nos
1c	ETC of 410 SP-76 14.5m Length Swagged pole for long span (includes excavation, refilling & required compaction)	4	Nos
2	Single pole V type cross arm		
A	Single Circuit Line		
2a	ETC of Suspension pole V type cross arm (1 Nos. MS channel 100x50-1450 long with back cleat 75x40-350long) along with pole top bracket including 2 Nos. M16X250 bolt & nut (structural steel to IS 808:2021)	67	Sets
2b	ETC of Tension pole V type cross arm (2 Nos MS channel 100x50-1450 long in one set) along with pole top bracket (to be fitted with pin insulator + both side strain insulator) including 4 Nos. M16X250 bolt & nut.	46	Sets
B	Double Circuit Line		
2c	ETC of Suspension pole V type cross arm (1Nos. MS channel 100x50-1450 long with back cleat 75x40-350long) including 6 Nos. M16X250 bolt & nut	36	Sets
2d	ETC of Tension pole V type cross arm (2 Nos MS channel 100x50-1450 long in one set) to be fitted with pin insulator + both side strain insulator including 6 Nos. M16X250 bolt & nut	12	Sets
3	Double pole cross arm and bracings		
3a	ETC of 2.6m length (MS channel 100x50mm) double pole cross arm for 1.5m pole apart for 30d-90d deviation	45	Sets
3a(i)	ETC of 1.7m length belting angle 60x60x6mm	74	Sets
3a(ii)	ETC of 3.0m length bracing angle 60x60x6mm	74	Sets
3b	ETC of 2.6m length (MS channel 100x50mm) double pole cross arm for 2.4m pole apart for **'dead end' double pole 11**kV OHL structure	2	Sets
3b(i)	ETC of 2.6m length belting angle 60x60x6mm	4	Sets
3b(ii)	ETC of 3.5m length bracing angle 60x60x6mm	4	Sets
3c	ETC of 2.6m length (MS channel 100x50mm) double pole cross arm for 2.4m pole apart for **'dead end' four pole** 11kV OHL structure	8	Sets
3c(i)	ETC of 2.6m length belting angle 60x60x6mm	16	Sets
3c(ii)	ETC of 3.5m length bracing angle 60x60x6mm	16	Sets
3d	ETC of 6.0m length (MS channel 150x75mm) double pole cross arm for 3.0m pole apart for **'long span' four pole**	4	Sets
3d(i)	ETC of 3.2m length belting angle 75x75x6mm	8	Sets
3d(ii)	ETC of 5.0m length bracing angle 75x75x6mm	8	Sets
B	**Conductor and Hardware**		
4	ETC of ACSR Conductor Dog	34000	Meter
5	ETC of Mid Span Compression Joints c/w steel inner sleeve suitable for ACSR dog	68	Sets
6	**Lighting Arrester & disconnecting Switch**		
6a	ETC of **3 phase Air Break Disconnecting Switch-11kV, 400A,** along with structure, hardware as required to be fitted on double pole MS channel	4	Sets
6b	ETC of **3 phase Lightening Arrestor LA-11kV, 10kA** along with structure, hardware as required to be fitted on double pole MS channel.	4	Sets
6c	ETC of fittings of above LA & Disconnecting Switch, 2.6m length (MS channel 100x50mm) double pole cross arm for 2.4m pole apart for 'dead end' double pole 11kV OHL	4	Sets
7	ETC of 11kV, 5 KN Pin Insulators complete with Steel Pin etc. having creepage distance of min 320mm	920	Nos
8	ETC of Aluminium Binding wire 3.66mm for above Pin insulators	2600	Meter
9	ETC of 11kV, 70 KN Polymer, Ball & Socket Type Strain Insulator having creepage distance of 320mm.	632	Sets

10	ETC of PG Clamp suitable for ACSR dog, 3-Bolt Type	660	Nos
11	ETC of 11kV, 70 KN Single Tension assembly complete with all necessary attachments i.e. D-Shackle, Ball Link, Socket eye, socket tongue and 4-Bolt Pistol Grip Tension Clamp 70kN suitable for ACSR dog	660	Sets
12	ETC of Vibration Dampers, Stockbridge type suitable for ACSR dog.	1200	Nos
13	ETC of Holding Clamp for ADSS	460	Nos.
C	**Miscellaneous Pole Accessories**		
14	ETC of Steel (Stay) Guy wire of size 7/3.15mm, Grade 1100 to IS: 2141:2000 breaking strength 53.5 kN	4300	Meter
15	ETC of Stay Rod M20 x 2400mm complete with Bow and thimble etc. with steel plate 150 x 150 x 6mm COMPLETE WITH STAY INSULATORS (includes excavation, refilling & required compaction)	275	Nos
16	ETC of Guy Grip for 7/3.15mm Stay wire, Grade 1100 to IS:2141:2000	275	Sets
17	Fitting of Standard size Danger plate suitable for 11kV OHL pole assembly	180	Nos
18	Fitting of Pole and Line number Plate suitable for 11kV OHL pole assembly	180	Nos
19	ETC of 165mm dia anti climbing device	219	Nos.
20	Localised earthing pit for every 5th pole shall be provided with pipe type / strip type set as below		
20a	ETC of Earthing set Pipe Type, 40 mm diameter, 2 metre long, class B, GI pipe with hardware as required.(includes excavation, refilling & required compaction)	15	Nos
20b	ETC of Strip earthing set 40 mm strip 5mm thick 10.0m long with hardware as required. (includes excavation, refilling & required compaction)	45	Nos
21	Security personnel: Watch & ward of stored / erected / commissioned material at storage area, project site, erection area or any other locations within project boundry as per material safety requirement and instruction of site in-charge complete in all aspect. Security personnel, round the clock watch & ward by authorized service agency consisting of security guard as per requirement at site. No. of post for watch & ward shall be decided by BHEL site in charge. (Unarmed security guard)	4	One post per month

NOTE:

1. Bidder shall consider all materials, consumables machinery tools & tackles, instruments and consumables required for erection, commissioning and testing of the 11 kv distribution lines system, while quoting in price bid.

SECTION-2: EQUIPMENT DETAILS

1. Tubular Steel Poles for Overhead Lines

1. Tubular Steel Poles shall be swaged type.
2. The tubular steel poles shall conform to the latest edition of Indian Standard specification IS: 2713 (Part – I, III): 1980.
3. For earthing arrangement, a through hole of 14mm diameter shall be provided in each pole at a height of 300mm above the planting depth.
4. The poles shall be galvanized steel tubes consisting of sections, to be jointed mechanically at the Site.
5. The manufacturer shall furnish all necessary guaranteed technical particulars (GTP) and relevant drawings during detail engineering.

2. MS Channel, Angle and Flat (used in cross arms, bracings)

1. The MS Channel, Angle and Flat shall conform to IS: 808:2021.
2. All above steel members shall be fabricated as per approved drawing having smooth edge, drilled circular/elliptical holes of suitable measurements.
3. All structural steel members and bolts shall be galvanized as per IS:4759 and zinc coating shall not be less than 610gm/sq. meter for all structural steel members. All weld shall be 6mm filled weld unless specified otherwise. All nuts and bolt shall be of property class 5.6 of IS 1367. Plain washers shall be as per IS 2016 and spring washers shall be IS:3063.
4. Material test certificates should be furnished during inspection.
5. The manufacturer shall furnish all necessary guaranteed technical particulars (GTP) and drawings during detail engineering.

3. ACSR Conductor and hardware

1. Type of conductor: ACSR Dog
2. Overall diameter: 14.15 mm

3. Aluminium strands: 6
4. Steel strands: 1
5. Calculated breaking load: 32.4 KN
6. Calculated resistance: 0.2722 ohm/km at 20 deg. c
7. The conductor shall be manufactured & tested as per IS 398.
8. Bolted type dead end clamps as well as other suitable type of necessary fittings, Accessories, Step Bolts etc. as per standards/established practices shall be supplied.

4. Air break disconnecting switch

1. voltage rating: 11kv
2. The short time current rating for 1 second should be 18 kA.
3. The Air break disconnecting switch shall conform to IS: 9921.

5. 11KV Lightening arrester

1. The Lightening arrester shall conform to IS 3070 (Part-3) and IEC 60099-4.
2. The Lightening arrester shall be Distribution class Surge Arrestor**.**
3. The short time current rating for 1 second should be 10 kA.

6. 11KV Pin insulator

1. The Air break disconnecting switch shall conform to IS: 731.
2. The minimum failing load shall be 5 KN.
3. The minimum creepage distance of pin shall be 320mm.

7. 11KV Polymer strain insulator

1. The Polymer strain insulator shall conform to IEC:61109.
2. The minimum failing load shall be 70 KN.
3. The minimum creepage distance of pin shall be 320mm.
4. The end fitting shall be Ball & socket type as per IEC 60120.

9. Guy Wire Assemblies

1. Each guy wire assembly shall include a pole band, a guy insulator, a turnbuckle, and a screw or plate type anchor rod, with thimbles, etc where needed.
2. The guy wires shall be connected to other components by means of preformed grips. Wire clips shall not be used for connection.
3. Steel (Stay) Guy wire shall be of size 7/3.15mm, Grade 1100 to IS: 2141:2000 having breaking strength 53.5 kN.

10. Danger plate

1. The danger plate shall be supplied & tested as per IS: 2551-1982.
2. The detail drawing of Danger notice plate shall be submitted during detail engineering.

3.	Roads and streets	6.0
6.	Power lines (above or below)	2.7

For other objects not listed above the requirements for minimum clearances shall comply also with NEA practice and National Electrical and Safety Code (NESC). Requirements of other standards/Code/established practice shall be subject to the approval of the Engineer.

Crossing of houses, huts and other objects with thatched soft roofing is not allowed.

8.7 TESTS ON DISTRIBUTION LINE MATERIALS

8.7.1 Tests on ACSR Conductor

A) General

1) The Bidder shall clearly indicate the details of the testing facilities available at his works. For the tests, which the Bidder intends to conduct at outside recognised laboratories, the details of testing facilities available in these laboratories shall be indicated in the bid. Type, Acceptance, Routine tests and Tests during manufacture shall be carried-out on the conductor.

2) Type Tests shall mean those tests, which are to be carried out to prove the process of manufacture and general conformity of the material to this specification. These tests shall be carried out on samples prior to commencement of commercial production against the order. The Bidder shall indicate his schedule for carrying out these tests.

3) Tests during Manufacture shall mean those tests which are to be carried out during the process of manufacture and inspection by the supplier to ensure the desired quality of the end product to be supplied by him.

4) Acceptance Tests shall mean those tests which are to be carried out on samples taken from each lot offered for pre-dispatch inspection, for the purposes of acceptance of that lot.

5) Routine Tests shall mean those tests, which are to be carried out on each strand/spool/length of the conductor to check requirements which are likely to vary during production.

6) The norms and procedure of sampling for these tests will be as per the Quality Assurance Programme to be mutually agreed to by the Supplier and the Emloyer/Engineer.

7) The standards and norms to which these tests will be carried out are as per IS:398 (Part-2). When a particular test is a specific requirement of this specification, the norms and procedure of the test shall be as specified in IS-398 (Part-2).

8) For all Type and Acceptance tests, the acceptance values shall be the values guaranteed by the Bidder in the guaranteed technical particulars of his proposal or the acceptance values specified in this specification, whichever is more stringent for that particular test.

B) Type Tests

Type test certificates of recognized test house for same size of conductor carried out earlier shall be acceptable if agreed to between the purchaser & the supplier. The following constitute the type tests.

a) Surface condition
b) Ultimate breaking load on stranding conductor :-

Circles perpendicular to the axis of the conductor shall be marked at two places on a sample of conductor of minimum 5 m length suitably compressed with dead end clamps at either end. The load shall be increased at a steady rate upto 50% breaking load and held for one minute. The circles drawn shall not be distorted due to relative movement of strands. Thereafter the load shall be increased at steady rate to 100% of the breaking load and held for one minute. The conductor sample shall not fail during this period. The applied load shall then be increased until the failing load is reached and the value recorded.

c) Stress strain Test
d) Measurement of diameter of individual aluminium & steel wires
e) Measurement of lay ratio
f) Breaking load of individual wires
g) Ductility test :-

The test procedures shall be as per clause No. 13.4.1 and 14.6.2 of IS:398 (Part-2) – 1996. In torsion test, the number of complete twists before fracture shall not be less than 18 on a length equal to 100 times the standard diameter of the strand before stranding and should not be less than 16 after stranding.

h) Wrapping test
i) D.C. Resistance test :-

On a conductor sample of minimum 5 m length two contact-clamps shall be fixed with a pre-determined bolt torque. The resistance shall be measured by a Kelvin Double Bridge by placing the clamps initially zero meter and subsequently one meter apart. The test shall be repeated at least five times and the average value recorded. The value obtained shall be corrected to the value at 20^{o}C as per clause No. 13.6 of IS:398-(Part-2)-1996. The resistance corrected at 20^{o} C shall conform to the requirements of this specification.

j) Galvanising test

C Routine Tests

a) Check to ensure that the joints are as per specifications.
b) Check that there are no cuts, fins etc. on the strands.
c) Check that drums are as per IS:1778-1980
d) All acceptance tests as mentioned

D Acceptance Test

a) Measurement of diameter of individual aluminium & steel wires.
b) Measurement of lay ratio
c) Breaking load of individual wires
d) Ductibity test
e) Wrapping test
f) Resistance test
g) Galvanising test
h) Visual & dimensional check of drum
i) Check for conductor surface, declared length & weight, sketches etc. Out of each lot offered, at least two drums shall be rewound in the presence of the inspector. The inspector shall visually check for.

   i) Scratches, joints etc. and that the conductor generally conform to the requirements of this specifications.
   ii) Detailed length and weight of the conductor drum.

E) Chemical Analysis of Zinc

Samples taken from the zinc ingots shall be chemically/spectrographically analyzed. The same shall be in conformity to the requirements stated in the specification.

F) Chemical Analysis of Aluminium and Steel

Samples taken from the Aluminium ingots/coils/strands shall be chemically/spectrographically analysed. The same shall be in conformity to the requirements stated in this specification.

8.7.2 Tests on Tubular Poles

The finished poles shall be supplied as well as tested as per IS:2713-1980 for the following:

a) Tensile test and chemical analysis for sulphur and phosphorous;

b) Deflection test;

c) Permanent set test; and

d) Drop test

The selection of poles for sample test shall be as per IS:2713-1980.

The retest on poles shall be performed as per IS:2713 and on structural as per, relevant Indian Standard Specification.

8.7.3 Tests on Insulators

1) The insulator discs and complete insulator strings shall be tested in accordance with IS:731-1971.

Insulator string hardware and locking devices for ball and socket coupling of insulator discs shall be subject to the tests as per IS:2486 (Part-1 and Part-4). The slip strength test for suspension clamps (where armour rods are used) will be conducted with armour rods installed on the conductor.

2) Tests

The following tests shall be conducted on a suitable number of individual discs, components, materials and complete strings. These tests shall be conducted as per procedure laid down in the relevant Indian Standards or IEC.

I) Type Tests

The type test certificates of the following tests shall be supplied along with the Bid by the manufacturer as per IS:731-1971 or as listed below :

a) Visual examination
b) Verification of dimensions
c) Visible discharge test
d) Impulse voltage withstand test
e) Wet power frequency voltage withstand test
f) Temperature cycle test
g) 24 hours mechanical strength test
h) Galvanising test
i) Metallurgical test
j) Eccentricity test for disc insulators

II) Acceptance Test

For Disc Insulator

a) Verification of dimensions
b) Temperature cycle test
c) Galvanising test
d) Puncture test
e) Electro-mechanical failing load test
f) Test on locking device for ball and socket coupling
g) Visual discharge test
h) Porosity test

III) Acceptance Tests on the Complete Insulator String with Hardware fittings :

a) Power frequency voltage withstand and flashover test with arcing horns.
   i) Dry
   ii) Wet
b) Voltage distribution test
c) Mechanical strength test
d) Vibration test
e) Thermal mechanical performance test and mechanical performance strength test
f) Impulse voltage withstand test
g) Visual examination
h) Verification of dimensions
i) Visible discharge test
j) Wet Power Frequency Voltage withstand test

k) Galvanising test

IV) Routine Test for disc insulators

a) Visual inspection
b) Mechanical routine tests
c) Electrical routine tests

V) Tests during Manufacture

On all components as applicable :

a) Chemical analysis of zinc used for galvanising.
b) Chemical analysis, mechanical and metallographic tests and magnetic particle inspection for malleable castings.
c) Chemical analysis, hardness tests and magnetic particle inspection for forging,
d) Hydraulic test on insulator shells.

3) In case of failure of the complete string or any item thereof in any of the tests, the manufacturer shall get the test repeated at his cost.

4) For type tests which involve the tests on the complete insulator string with hardware fittings, the manufacturer of hardware fittings shall supply the necessary number of sets of hardware fittings at the place of test free of cost.

5) Bidders shall indicate the laboratories in which they propose to conduct various tests. They shall ensure that the tests can be completed in these laboratories within the time schedule guaranteed by them in the appropriate schedule.

6) The entire cost of testing for various tests specified herein shall be treated as included in the quoted unit price.

8.7.4 Tests on Hardware Fittings

The helically formed fittings for strain insulators shall be subjected to tests as per IS: 12048-1987 or equivalent. The other hardware fittings shall be tested as per IS:2486 (Part-I).

1. Fittings for Strain Insulators with Conventional Dead-end Clamps

I. Fittings for strain insulators with conventional dead-end clamps for use with tongue & clevis or ball & socket type insulators shall consist of the following components:

a) Cross arms strap conforming to IS:2486 (Pt.II)-1989 or equivalent.

II. Dead-end clamp made of aluminium alloy to suit 'DOG' ACSR conductors. The ultimate strength of the clamp shall not be less than 3000 Kg.

III. Tests

The fittings shall be subjected to type, routine and acceptance tests in accordance with the stipulations of IS:2486 (Pt.I) or equivalent.

2. String Insulator Fittings

I. The hardware fittings shall be suitable for ball and socket type insulator. Each hardware fitting shall be supplied complete in all respects.

II. The common snail type strain clamp shall be suitable for specified ACSR conductor.

III. The tension hardware with 3 or 4 bolts strain hardware shall have a minimum failing load, not less than 95% of strength of respective conductor.

IV. The bolted type strain clamps shall be :

A) Dog 3 bolted type

V. Suspension hardware fittings shall be :

a) Envelop type clamp and hardware for Dog conductor

VI. The envelop type suspension hardware suitable for Dog conductor shall have minimum failing load of 30 KN.

VII. The suspension clamp shall have slip strength not exceeding 20% of conductor rated strength. The conductor shall not slip at loads less than 12.5% of rated strength of conductor.

VIII. Designation

Ball and Socket Designation

The dimensions of the ball and socket shall be 16 mm designation wherever 70 kN disc insulator are used. The design should be in accordance with the standard dimensions stated in IS:2486-(Part-II)/IEC: 120. The dimensions shall be checked by the appropriate gauge after galvanising only.

IX. Security Clips and Split Pins

Security clips for use with ball and socket coupling shall be R-shaped, hump type which provides positive locking of the coupling as per IS:2486-(Pan-III)/ IEC : 372. The legs of the security clips shall be spread after assembly in the works to prevent complete withdrawal from the socket. The locking device should be resilient, corrosion resistant and of suitable mechanical strength. There shall be no risk of the locking device being displaced accidentally or being rotated when in position. Under no circumstances shall the split pins shall be used with bolts & nuts.

X. Suspension Assembly

a) The suspension clamp shall be designed to have maximum mobility in any direction and minimum moment of inertia so as to have minimum stress on the conductor in the case of oscillation of the same.

b) The suspension assembly shall be designed, manufactured and finished to give it a suitable shape, so as to avoid any possibility of hammering between suspension assembly and conductor due to vibration. The suspension assembly shall be smooth without any cuts, grooves, abrasions, projections, ridges or excrescence which might damage the conductor.

c) The suspension assembly/clamp shall be designed so that it shall minimize the static & dynamic stress developed in the conductor under various loading conditions as well as during wind induced conductor vibrations. It shall also withstand power arcs.

XI. Envelope Type Suspension Clamp

The seat of the envelope type suspension clamp shall be smoothly rounded & suitably curved at the ends. The lip edges shall have rounded head. There shall be

at least two V-bolts for tightening of clamp body and keeper pieces together. Hexagonal bolts and nuts with split-pins shall be used for attachment of the clamp.

XII. Fasteners: Bolts, Nuts and Washers

a) All bolts and nuts shall conform to IS:6639. All bolts and nuts shall be galvanised as per IS-1367 - (Part 13)/IS-2629. All bolts and nuts shall have hexagonal heads, the heads being forged out of solid truly concentric, and square with the shank, which must be perfectly straight.

b) Bolts upto M 16 and having length upto 10 times the diameter of the bolt should be manufactured by cold forging and thread rolling process to obtain good and reliable mechanical properties and effective dimensional control. The shear strength of bolt for 5.6 grade should be 310 MPa minimum as per IS-.12427. Bolts should be provided with washer face in accordance with IS: 1363 Part-I to ensure proper bearing.

c) Nuts should be double chamfered as per the requirement of IS: 1363 Part-III 1984. It should be ensured by the manufacturer that nuts shou1d not be over tapped beyond 0.4 mm oversize on effective diameter for size upto M 16.

d) Fully threaded bolts shall not be used. The length of the bolt shall be such that the threaded portion shall not extend into the place of contact of the component parts.

e) All bolts shall be threaded to take the full depth of the nuts and threaded enough to permit the firm gripping of the component parts but no further. It shall be ensured that the threaded portion of the bolt protrudes not less than 3 mm and not more than 8 mm when fully tightened. All nuts shall fit and tight to the point where shank of the bolt connects to the head.

f) Flat washers and spring washers shall be provided wherever necessary and shall be of positive lock type. Spring wasi1ers shall be electro-galvanised. The thickness of washers shall conform to IS:2016.

g) The Bidder shall furnish bolt schedules giving thickness of components connected the nut and the washer and the length of shank and the threaded portion of bolts and size of holes and any other special details of this nature.

h) To obviate bending stress in bolt, it shall not connect aggregate thickness more than three time its diameter.

i) Bolts at the joints shall be so staggered that nuts may be tightened with spanners without fouling.

j) To ensure effective in-process Quality control it is essential that the manufacturer should have all the testing facilities for tests like weight of zinc coating, shear strength, other testing facilities etc, inhouse. The manufacturer should also have proper Quality Assurance system which should be in line with the requirement of this specification and IS- 14000 services Quality System standard.

k) Fastners of grade higher than 8.8 are not to be used.

XIII. Tests

Type Tests

(a) Visual examination
(b) Verification of dimensions
(c) Slip strength test
(d) Heating cycle test
(e) Mechanical strength test
(f) Electrical Resistance test

Acceptance Tests

(a) Visual examination
(b) Verification of dimensions
(c) Galvanising/Electroplating test
(d) Mechanical strength test of each component
(e) Mechanical strength test of welded joint
(f) Chemical analysis, hardness tests, grain size, inclusion rating & magnetic particle inspection for forgings/castings
(g) Clamp slip strength Vs Torque test for suspension clamp

Routine Tests

(a) Visual examination
(b) Proof Load Test

8.7.5 TEST ON ISOLATOR/AIR BREAK DISCONNECTING SWITCH

8.7.5.1 Type Tests

The type tests should be carried out in accordance with IS:9921. However, for guidance of the tenderer, different type tests are mentioned below :

a) Temperature rise test (for contacts & terminals)
b) Measurement of Resistance of Main Circuit
c) Short Circuit current carrying capability for 1 second. The short time current rating for 1 second should be 18 kA.
d) Dielectric test
e) Mainly active load breaking capacity test
f) Transformer off-load breaking capacity test
g) Line charging breaking capacity test
h) Cable charging breaking capacity test
i) Operation & mechanical endurance test

Type test certificates shall be submitted if these are already carried out by the manufacturers on the similar A.B. Switches for acceptance.

8.7.5.2 Acceptance tests for complete Isolators

The following shall be acceptance tests for complete Isolators :

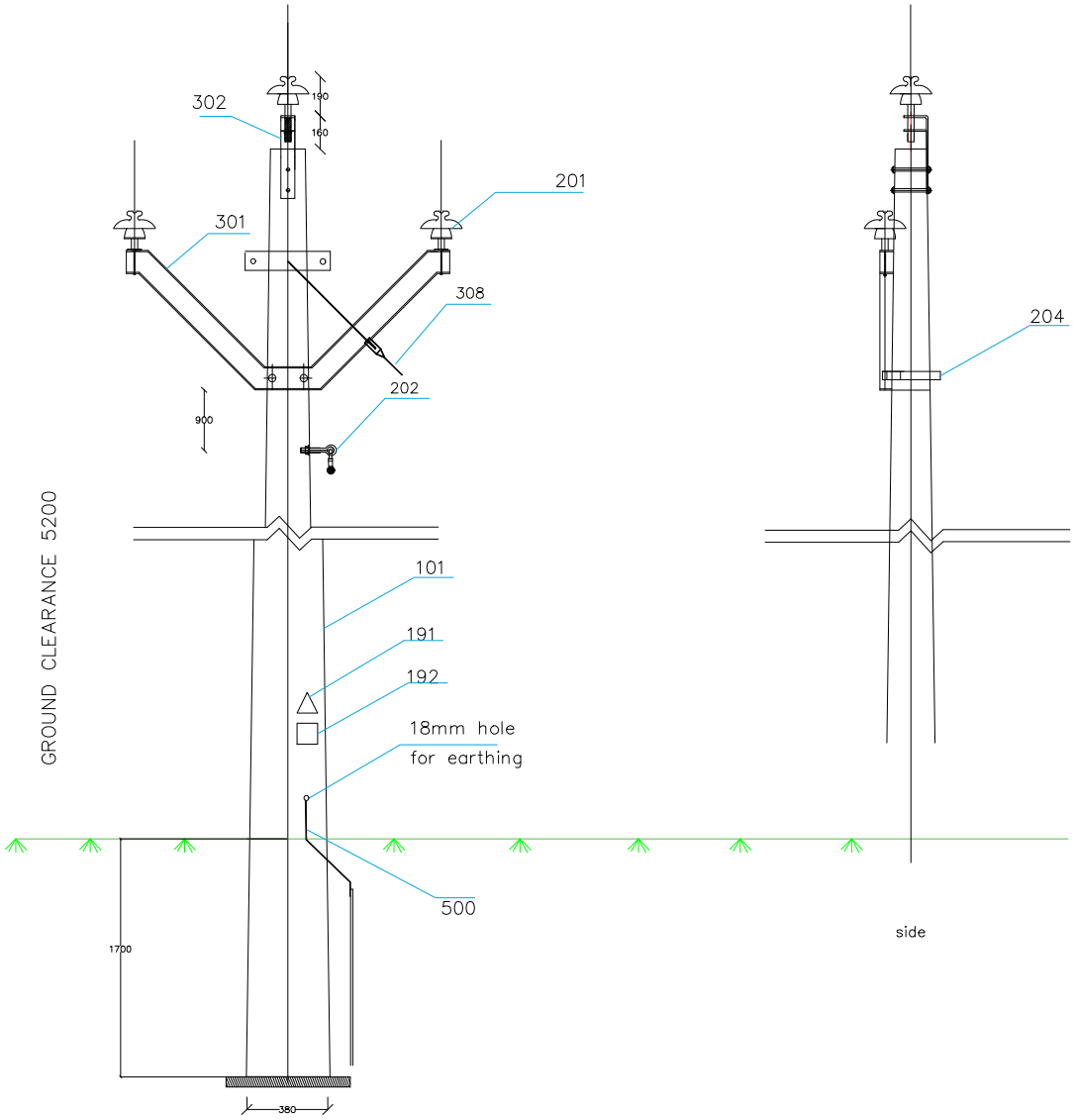
a) Temperature rise test as per IS:9921.
b) Measurement of resistance of the Main Circuit.
c) Power frequency voltage (Dry) test on Main circuit.
d) Verification of dimensions.
e) Mechanical test on post insulators as per IS:2544.
f) Galvanizing test as per IS:2544.

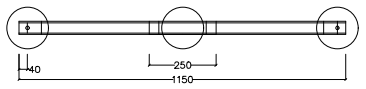
The post insulator shall be inspected at the works of the original manufacturer of post insulators. The A.B. Switch shall be supplied duly assembled.

8.7.5.3 Routine Tests

Every switch manufactured will be subjected to routine test as per IS mentioned below :

i) Power frequency voltage test (Dry) on isolators which are completely assembled at Manufacturer's works.
ii) Measurement of resistance of the main circuit.
iii) Tests to prove satisfactory operation.





plan

Note:

To be used for single circuit (S/C)

11m Single pole without stay for 0 deg deviation

11m Single pole with stay for deviation angle >0 deg

ITEM	QTY	DESCRIPTION
308	1	GUY/STAY WIRE SET FOR DEVIATION ANGLE >0
500	1	EARTHING COMPLETE
301	1	V-CROSS ARM(M.S.CHANNEL-100x50)
302	1	POLE TOP BRACKET WITH BOLTS M16X250mm LONG
204	1	BACK CLAMP
201	3	11KV PIN INSULATOR SET
101	1	410-SP55 SWAGGED POLE 11M LENGTH
192	1	POLE&LINE NUMBER PLATE
191	1	DANGER PLATE
202	1	ADSS

A3	M3	R3D	R3N	Drawn	04.07.24	SS	Client- RAGHUGANGA POWER LIMITED	
A2	M2	R2D	R2N	Check	04.07.24	AKS	Plant- RAGHUGHAT HYDRO ELECTRIC PROJECT(2X20MW)	
A1	M1	R1D	R1N	Appr.			Project-No. OR	
A/M	Modification	Date	Des.	Scale		SC	File/Date MO	FI

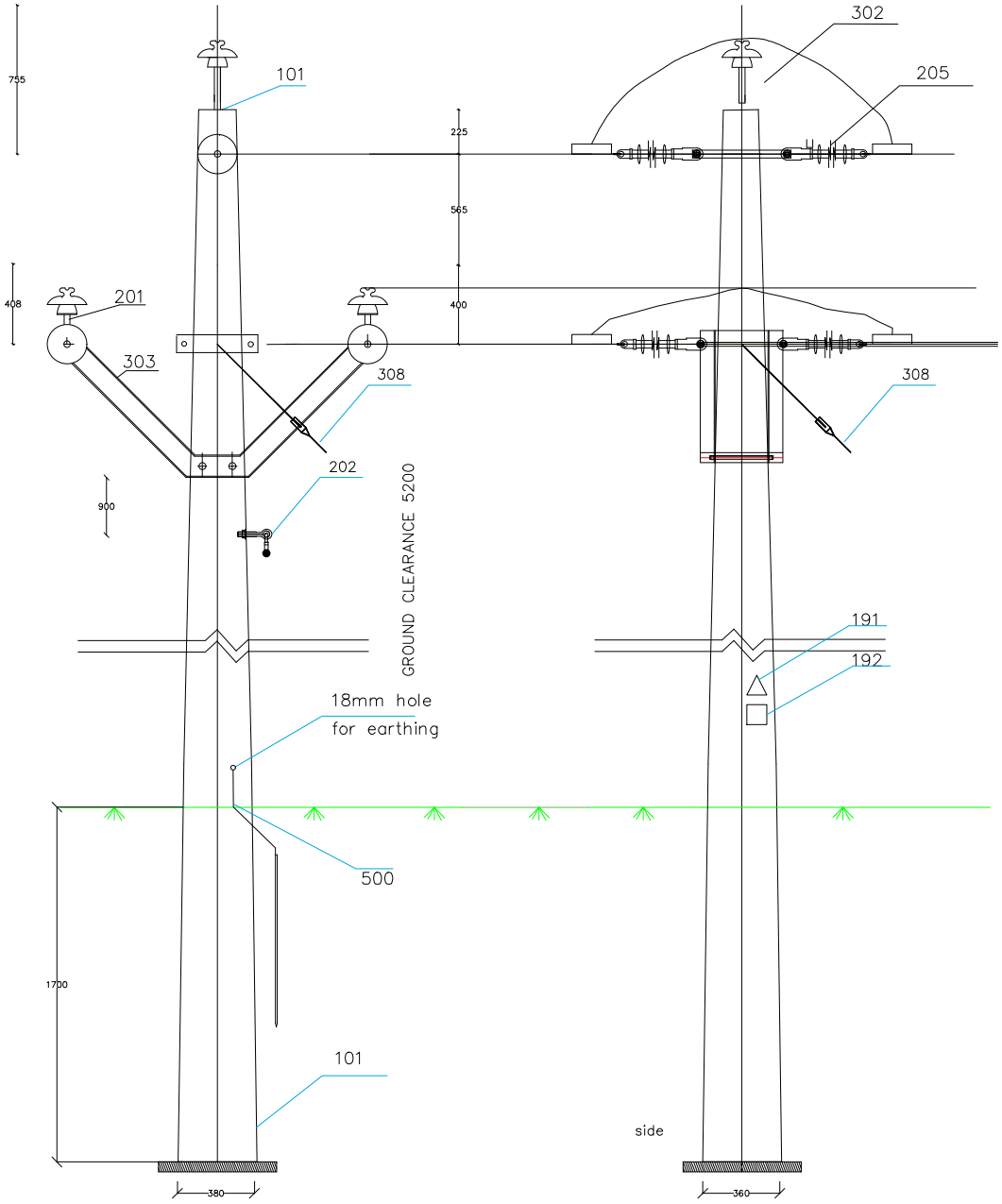
TITLE :

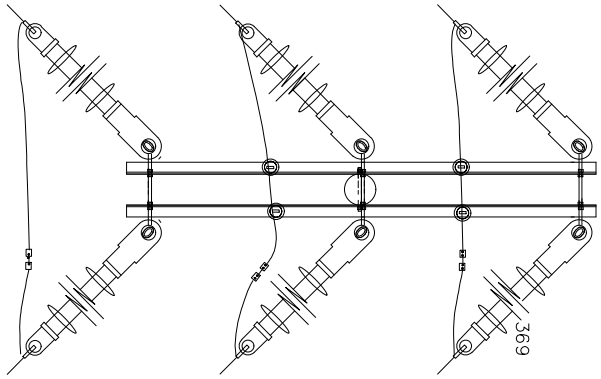
0-10 d single poles with/without stay
S/C Intermediate Assembly

Int. N° | =FU PLN | +LO

Draw. N° TDC/BHEL/RHP/KED/01

Index RE | Bl./Sht. S1 von/of S2 | A3





plan

Note:

To be used for single circuit (S/C)
11m Single pole for deviation angle 0-30d

ITEM	QTY	DESCRIPTION
500	1	EARTHING COMPLETE
308	2	GUY/STAY WIRE SET
303	1	V-CROSS ARM(M.S.CHANNEL-100x50)
302	1	POLE TOP BRACKET
205	6	11kv,45 KN Polymer Strain Insulator
203	4	BOLTS M16x250mm
201	3	11KV PIN INSULATOR SET
202	1	ADSS
101	1	410-SP55 SWAGGED POLE 11M LENGTH
192	1	POLE & LINE NUMBER PLATE
191	1	DANGER PLATE

A3	M3	R3D	R3N	Drawn	04.07.24	SS	Client- RAGHUGANGA POWER LIMITED	
A2	M2	R2D	R2N	Check	04.07.24	AKS	Plant- RAGHUGHAT HYDRO ELECTRIC PROJECT(2X20MW)	
A1	M1	R1D	R1N	Appr.			Project-No. OR	
A/M	Modification	Date	Des.	Scale		SC	File/Date MO	FI

BHEL

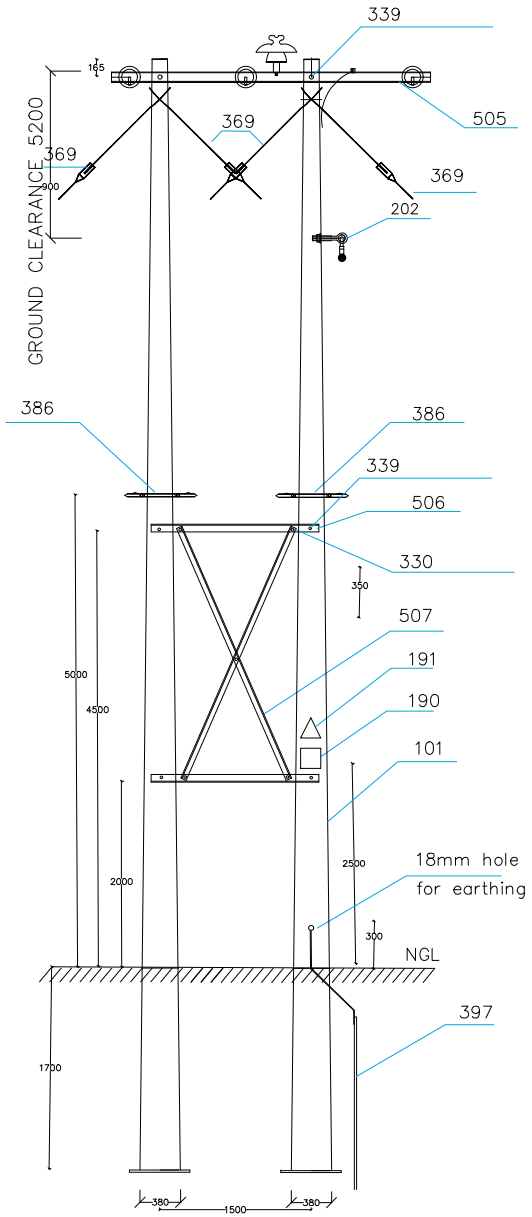
TITLE :
0-30 d single poles with stay
S/C with strain insulator

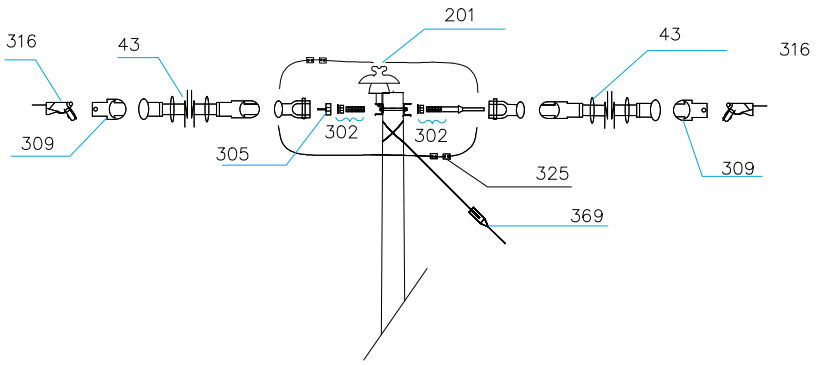
Int. N° =FU PLN
+LO

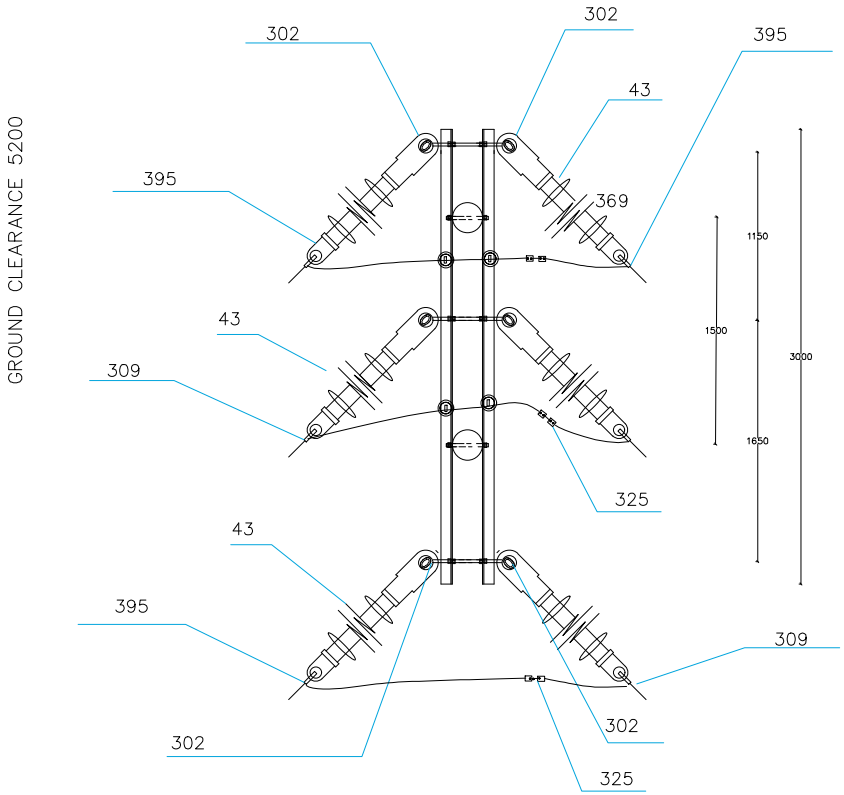
Draw. N° TDC/BHEL/RHP/KED/02

Index RE Bl./Sht. S1 von/of S2 A3

CAD ASSTUZ







Note:
To be used for single circuit (S/C)
11m Double pole for deviation angle 30-60d

Item	Qty	Description
507	2	Bracing angle L 60x60x6mm
506	2	belting angle L 60x60x6mm
397	1	Earthing set
386	2	165mm dia anti climbing device
505	2	2.6m long cross arm IMC 100x50
395	3	Aluminium Binding wire 3.66mm
369	4	MV Stay Assembly Complete
330	6	HDG Hex Nut M10
325	6	PG Clamp suitable for ACSR Dog, 3-bolt Type
316	6	HDG Pistol Grip Tension Clamp 70kN-suitable for Dog
309	6	HDG Socket EYE 70kN
305	3	HDG Eye Nut M20 70kN
302	3	HDG Clevis Bolt M20x350mm 70kN c/w 4 nuts & 2 RF washers
201	4	11KV PIN INSULATOR SET
202	1	ADSS
191	1	Danger Plate
190	1	Pole & Line Nr. Plate
101	2	410-SP55 SWAGGED POLE 11M LENGTH
43	6	11kv, 45KN Polymer strain Insulator

339 2 HDG Hex Bolt M20x250/200mm

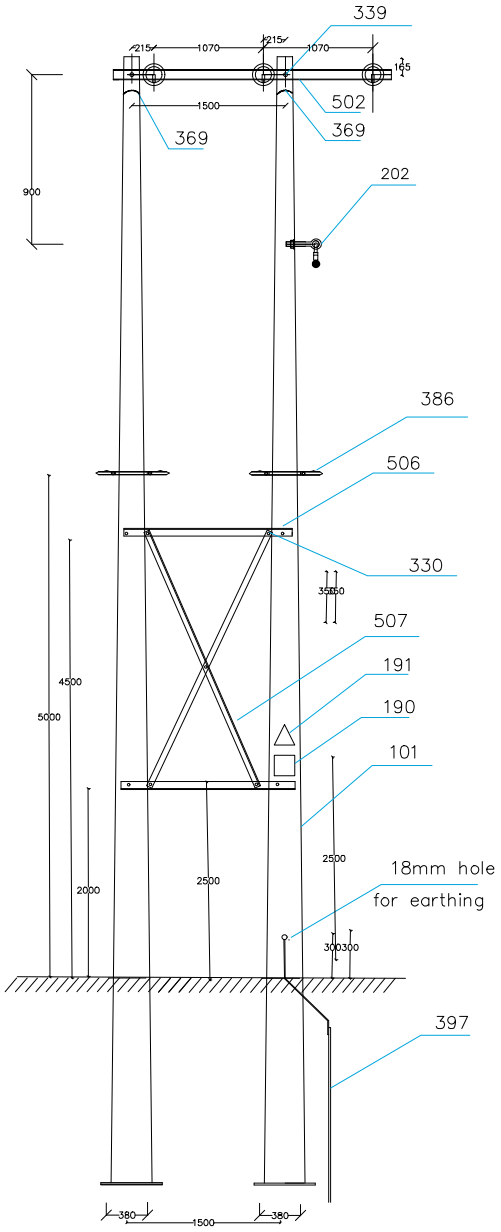
A3	M3	R3D	R3N	Drawn	04.07.24	SS	Client- RAGHUGANGA POWER LIMITED
A2	M2	R2D	R2N	Check	04.07.24	AKS	Plant- RAGHUGHAT HYDRO ELECTRIC PROJECT(2X20MW)
A1	M1	R1D	R1N	Appr.			Project-No. OR
A/M	Modification	Date	Des.	Scale		SC	File/Date MO FI

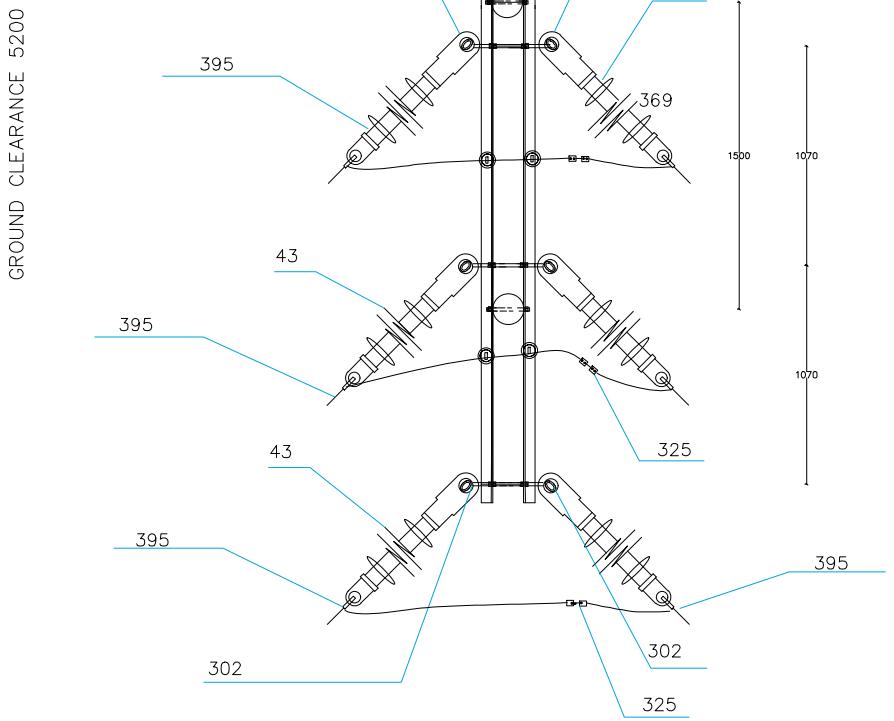
TITLE :
30-60 d double poles with stay
S/C with strain insulator

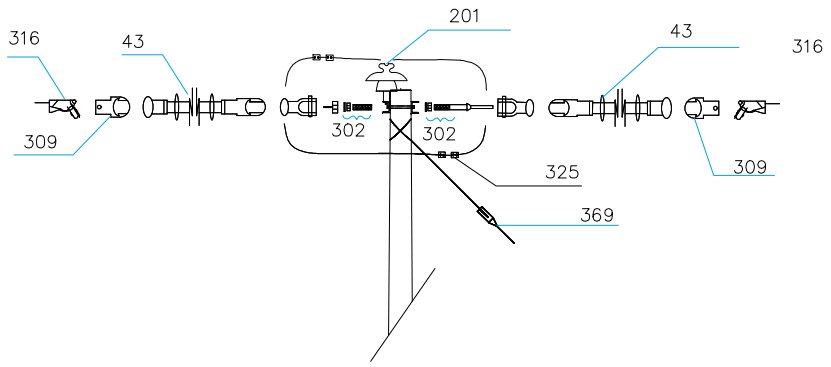
Int. N° | =FU PLN | +LO

Draw. N° TDC/BHEL/RHP/KED/03 | Index RE | Bl./Sht. S1 von/of S2 | A3

A3ST02 CAD







Note:
To be used for single circuit (S/C)
11M Double pole for deviation angle 60-90

Item	Qty	Description
507	2	Bracing angle L 60x60x6mm
506	2	Belting angle L 60x60x6mm
397	1	Earthing set
386	2	165mm dia anti climbing device
502	2	2.6m long cross arm IMC 100x50
395	3	Aluminium Binding wire 3.66mm
369	2	MV Stay Assembly Complete
330	6	HDG Hex Nut M10
325	6	PG Clamp suitable for ACSR Dog, 3-bolt Type
316	3	HDG Pistol Grip Tension Clamp 70kN-suitable for Dog
309	6	HDG Socket EYE 70kN
302	3	HDG Clevis Bolt M20x250 70KN c/w 2 nuts & 2 RF washers
330	6	HDG Hex Nut M10
201	4	Pin insulator
202	1	ADSS
191	1	Danger Plate
190	1	Pole & Line Nr. Plate
101	2	410-SP55 SWAGGED POLE 11M LENGTH
43	3	11kv, 45KN Polymer strain Insulator

A3	M3	R3D	R3N	Drawn	04.07.24	SS	Client- RAGHUGANGA POWER LIMITED
A2	M2	R2D	R2N	Check	04.07.24	AKS	Plant- RAGHUGHAT HYDRO ELECTRIC PROJECT(2X20MW)
A1	M1	R1D	R1N	Appr.			Project-No. OR
A/M	Modification	Date	Bearb./Des.	Scale		SC	File/Date MO FI

TITLE :
Deviation angle 60-90d
S/C with strain insulator

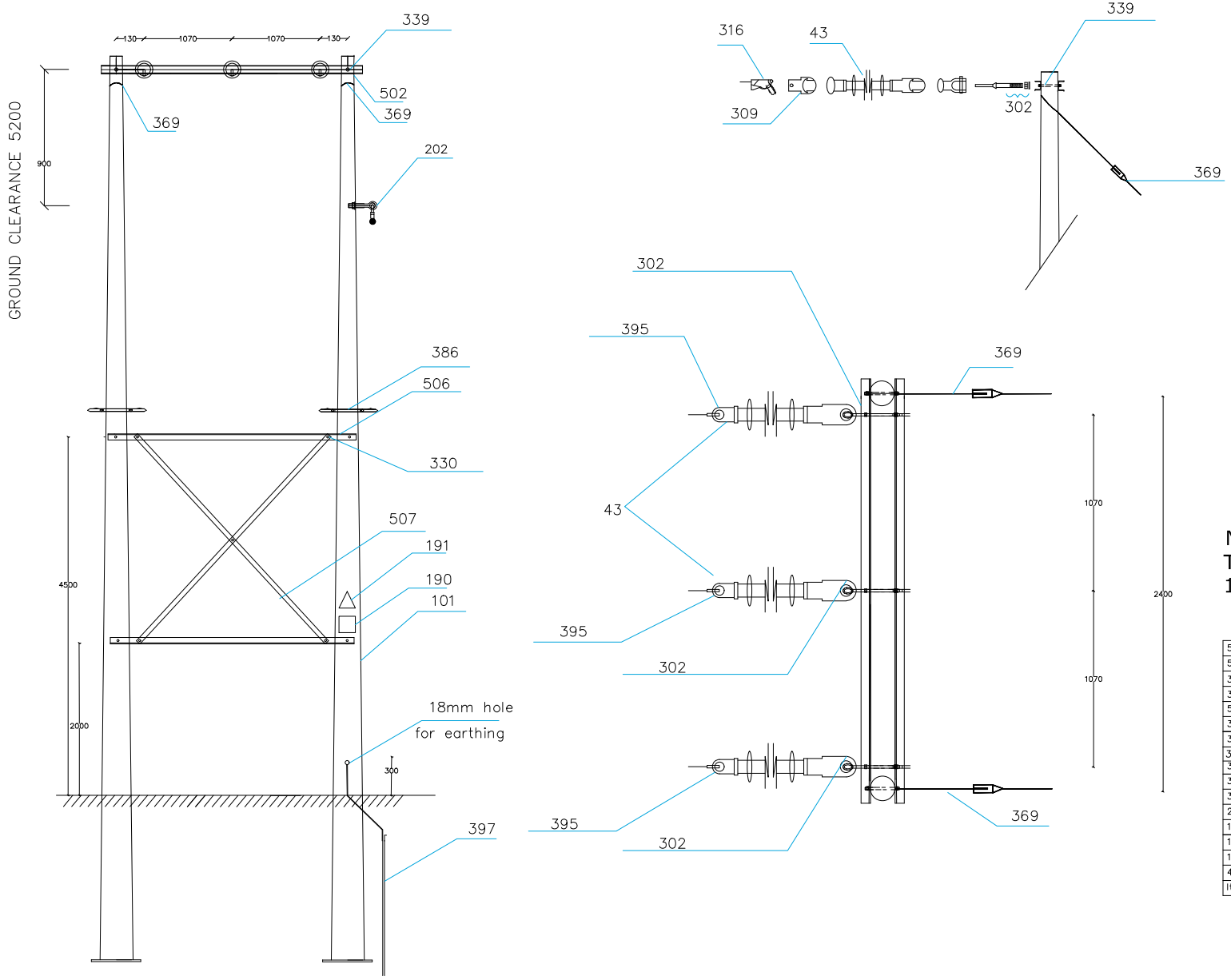
Int. N° =FU PLN +LO

Drawn. N° TDC/BHEL/RHP/KED/04

Index RE

Bl./Sht. S1 von/of S2 A3

CAD A3ST02



Note:
To be used for single circuit (S/C)
11m double pole Dead End assembly

Item	Qty	Description
507	2	Bracing angle L 60x60x6mm
506	2	Belting angle L 60x60x6mm
397	1	Earthing set
386	2	165mm dia anti climbing device
502	2	2.6m long cross arm IMC 100x50
395	3	Aluminium Binding wire 3.66mm
369	2	MV Stay Assembly Complete
330	6	HDG Hex Nut M10
316	3	HDG Pistol Grip Tension Clamp 70kN-suitable for Dog
309	6	HDG Socket EYE 70kN
302	3	HDG Clevis Bolt M20x250 70KN c/w 2 nuts & 2 RF washers
202	1	ADSS
191	1	Danger Plate
190	1	Pole & Line Nr. Plate
101	2	410-SP55 SWAGGED POLE 11M LENGTH
43	3	11kv, 45KN Polymer strain Insulator

A3	M3	R3D	R3N	Drawn	04.07.24	SS	Client- RAGHUGANGA POWER LIMITED
A2	M2	R2D	R2N	Check	04.07.24	AKS	Plant- RAGHUGHAT HYDRO ELECTRIC PROJECT(2X20MW)
A1	M1	R1D	R1N	Appr.			Project-No. OR
A/M	Modification	Date	Des.	Scale		SC	File/Date MO FI

TITLE :
Dead End double poles assembly
S/C with strain insulator

Int. N° =FU PLN +LO

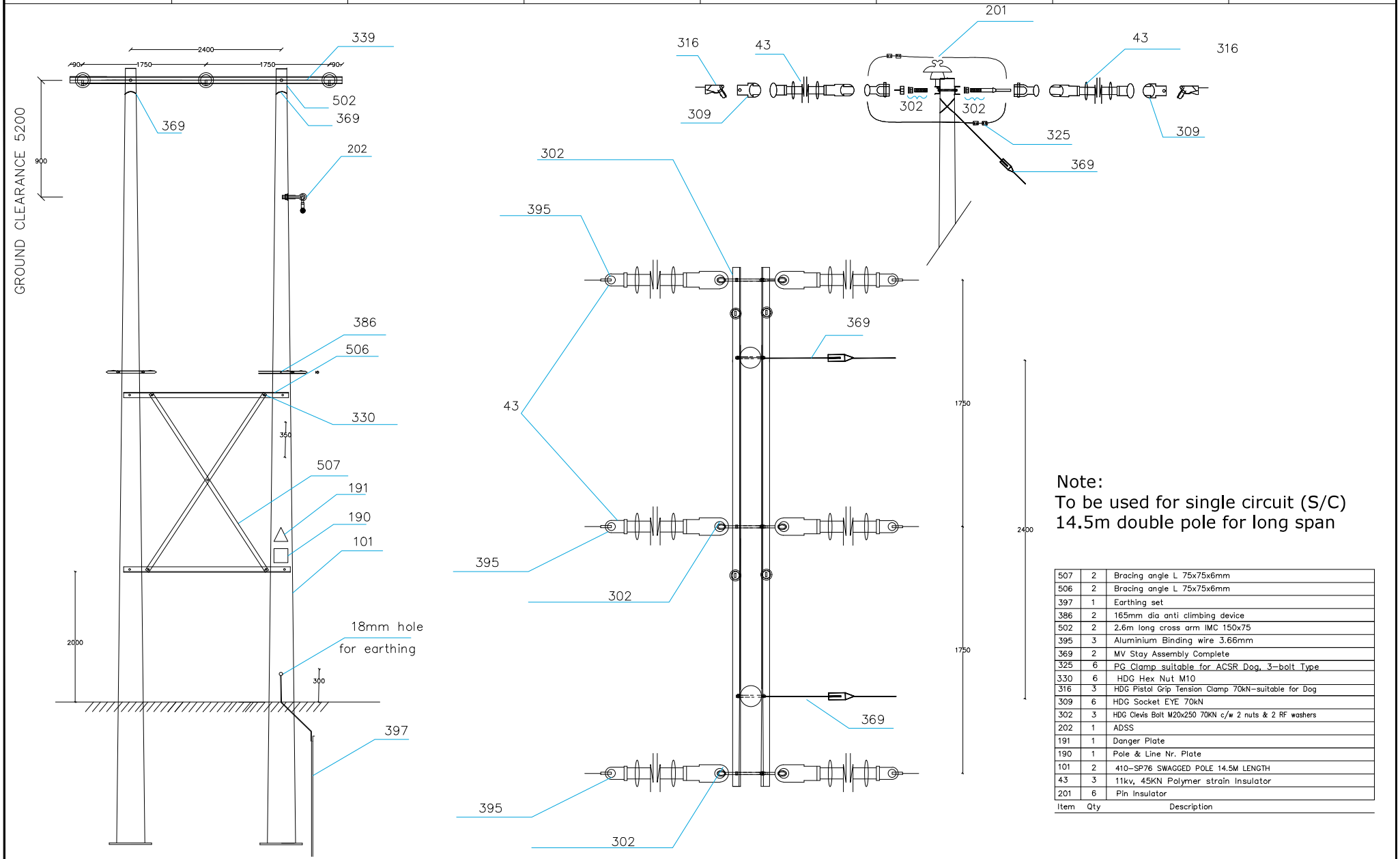
Draw. N° TDC/BHEL/RHP/KED/05

Index RE

Bl./Sht. S1 von/of S2

A3

CAD A3S102



Note:
To be used for single circuit (S/C)
14.5m double pole for long span

Item	Qty	Description
507	2	Bracing angle L 75x75x6mm
506	2	Bracing angle L 75x75x6mm
397	1	Earthing set
386	2	165mm dia anti climbing device
502	2	2.6m long cross arm IMC 150x75
395	3	Aluminium Binding wire 3.66mm
369	2	MV Stay Assembly Complete
325	6	PG Clamp suitable for ACSR Dog, 3-bolt Type
330	6	HDG Hex Nut M10
316	3	HDG Pistol Grip Tension Clamp 70kN-suitable for Dog
309	6	HDG Socket EYE 70kN
302	3	HDG Clevis Bolt M20x250 70KN c/w 2 nuts & 2 RF washers
202	1	ADSS
191	1	Danger Plate
190	1	Pole & Line Nr. Plate
101	2	410-SP76 SWAGGED POLE 14.5M LENGTH
43	3	11kv, 45KN Polymer strain Insulator
201	6	Pin Insulator

A3	M3	R3D	R3N	Drawn	04.07.24	SS	Client- RAGHUGANGA POWER LIMITED
A2	M2	R2D	R2N	Check	04.07.24	AKS	Plant- RAGHUGHAT HYDRO ELECTRIC PROJECT(2X20MW)
A1	M1	R1D	R1N	Appr.			Project-No. OR
A/M	Modification	Date	Des.	Scale		SC	File/Date MO FI

CAD A3ST02

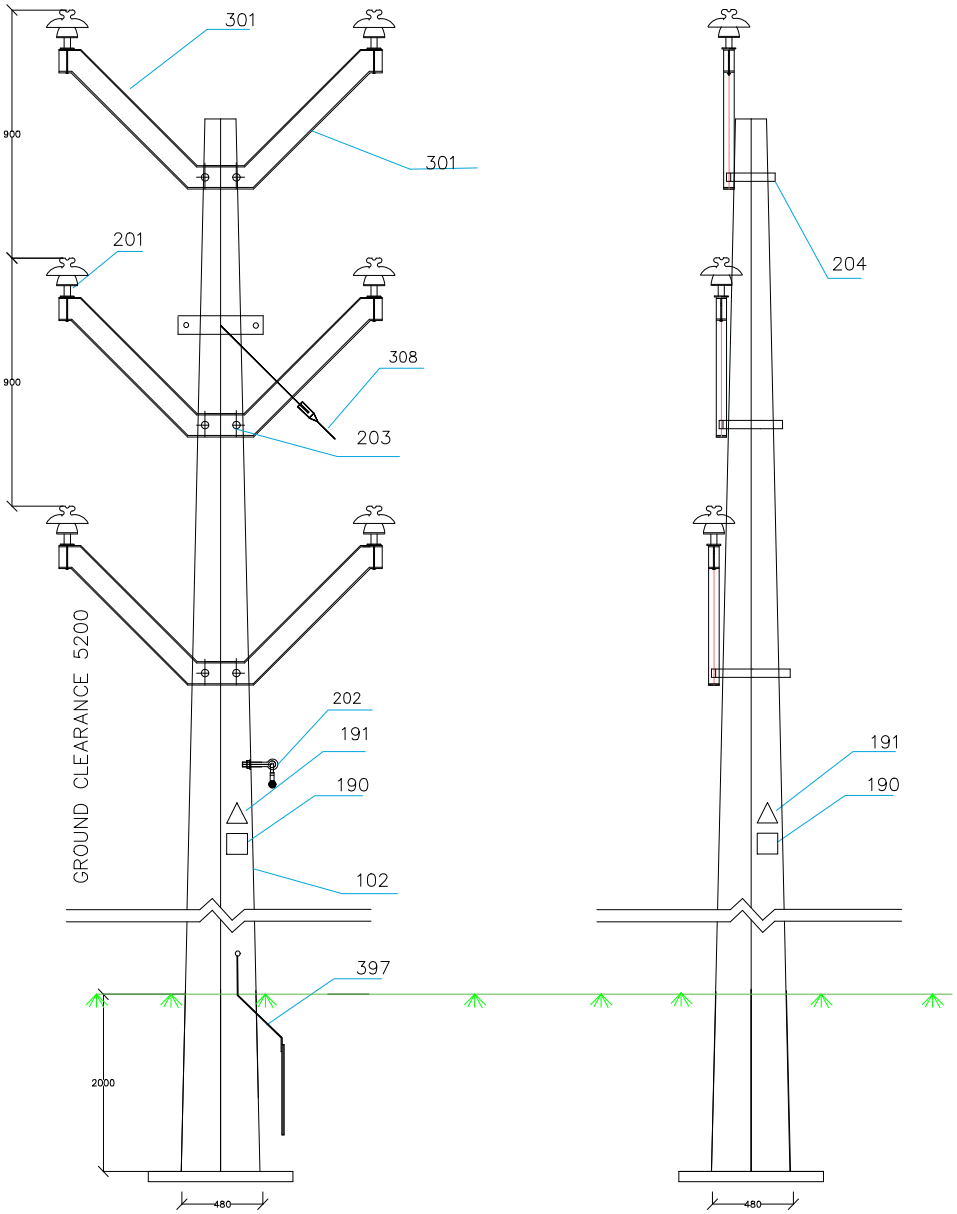
TITLE :
Double pole for long span
S/C with strain insulator

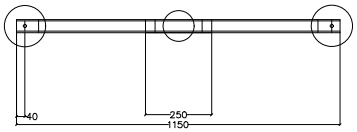
Int. N° =FU PLN +LO

Drow. N° TDC/BHEL/RHP/KED/06

Index RE

Bl./Sht. S1 von/of S2 A3





plan

Note:

To be used for double circuit (D/C)

13m Single pole without stay for 0 deg deviation

13m Single pole with stay for deviation angle >0 deg

ITEM	QTY	DESCRIPTION
308	1	GUY/STAY WIRE SET FOR DEVIATION ANGLE >0
397	1	EARTHING COMPLETE
301	3	V-CROSS ARM(M.S.CHANNEL-100x50)
204	3	BACK CLAMP
203	6	BOLTS M16x250mm
202	1	ADSS
201	6	11KV INSULATOR PIN
102	1	410-SP72 SWAGGED POLE 13M LENGTH
191	1	POLE&LINE NUMBER PLATE
190	1	DANGER PLATE

A3	M3	R3D	R3N	Drawn	04.07.24	SS	Client- RAGHUGANGA POWER LIMITED
A2	M2	R2D	R2N	Check	04.07.24	AKS	Plant- RAGHUGHAT HYDRO ELECTRIC PROJECT(2X20MW)
A1	M1	R1D	R1N	Appr.			Project-No. OR
A/M	Modification	Date	Des.	Scale		SC	File/Date MO FI

BHEL

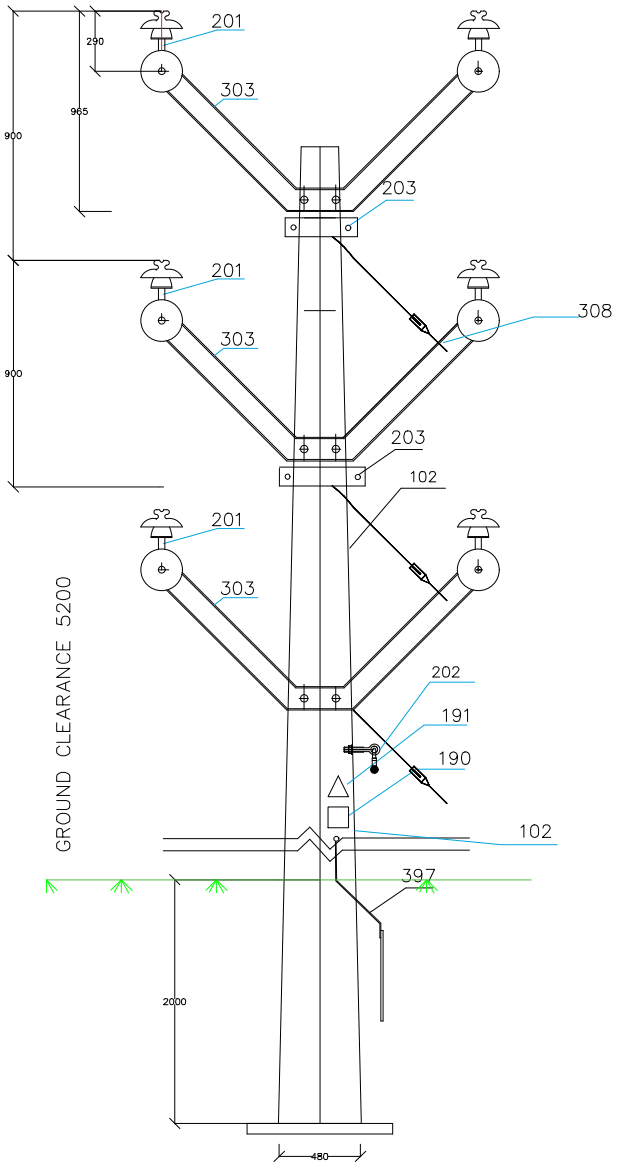
TITLE :
0 d single poles with/without stay
D/C Intermediate Assembly

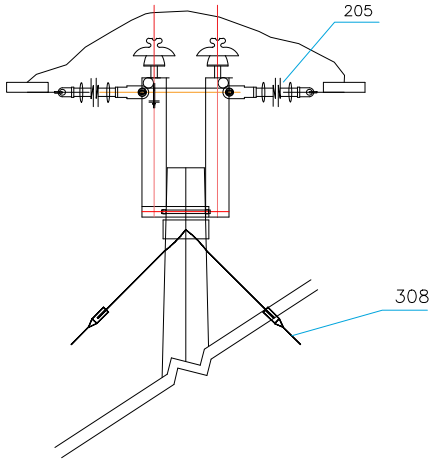
Int. N° =FU PLN +LO

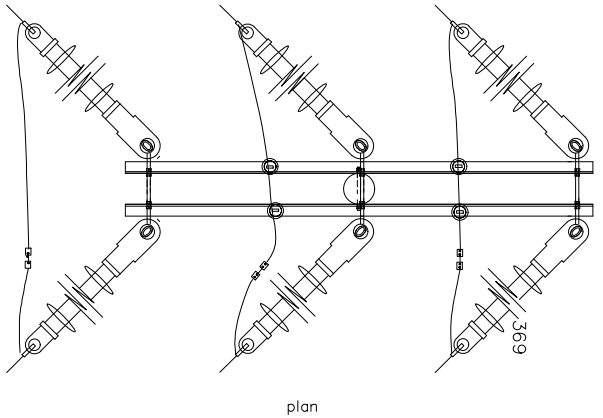
Draw. N° TDC/BHEL/RHP/KED/07

Index RE Bl./Sht. S1 von/of S2 A3

CAD A3ST02







Note:

To be used for double circuit (D/C)
13m Single pole for deviation angle 0-30d

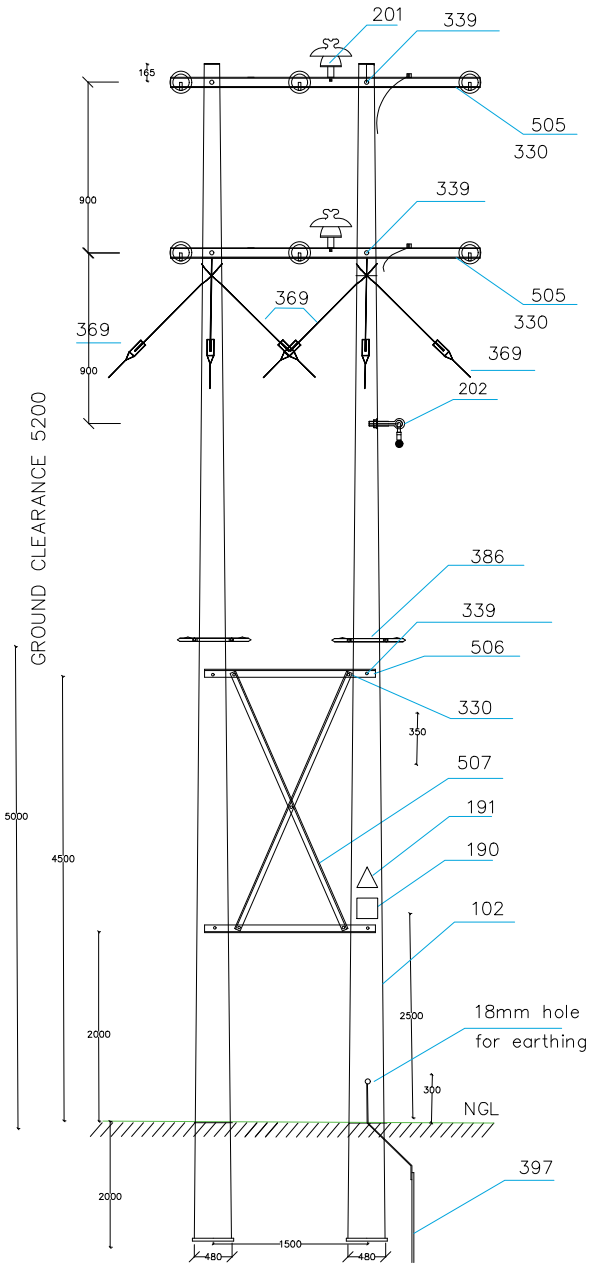
ITEM	QTY	DESCRIPTION
397	1	EARTHING COMPLETE
308	3	GUY SET
303	3	V-CROSS ARM(M.S.CHANNEL-100x50)
205	6	11kv, 45KN Polymer strain Insulator
203	12	BOLTS M16x250mm
202	1	ADSS
201	6	11KV INSULATOR PIN
102	1	410-SP72 SWAGGED POLE 13M LENGTH
191	1	POLE&LINE NUMBER PLATE
190	1	DANGER PLATE

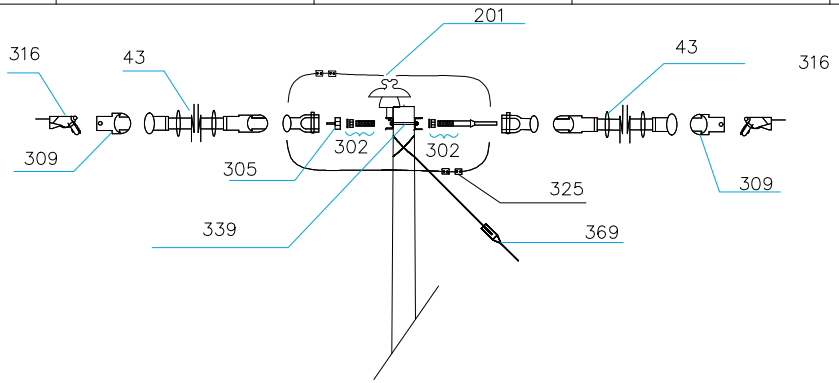
A3	M3	R3D	R3N	Drawn	04.07.24	SS	Client- RAGHUGANGA POWER LIMITED	
A2	M2	R2D	R2N	Check	04.07.24	AKS	Plant- RAGHUGHAT HYDRO ELECTRIC PROJECT(2X20MW)	
A1	M1	R1D	R1N	Appr.			Project-No. OR	
A/M	Modification	Date	Des.	Scale		SC	File/Date MO	FI

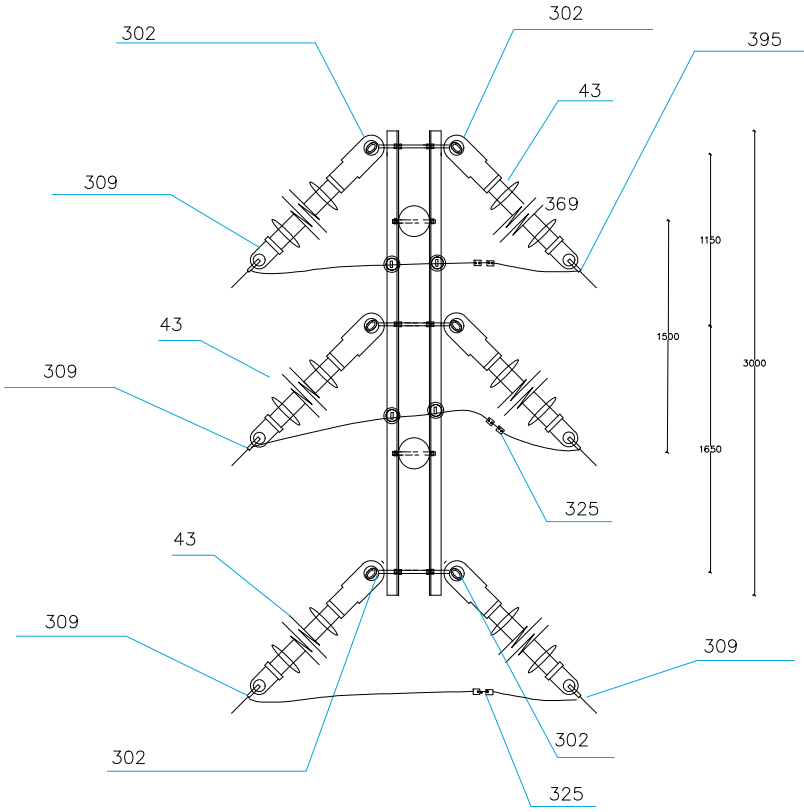
TITLE :
0-30 d single poles with stay
D/C with strain insulator

Int. N° | =FU PLN | +LO

Drow. N° TDC/BHEL/RHP/KED/08 | Index RE | Bl./Sht. S1 von/of S2 | A3







Note:
To be used for double circuit (D/C)
13m Double pole for deviation angle 30-60d

Item	Qty	Description
507	2	Bracing angle L 60x60x6mm
506	2	Belting angle L 60x60x6mm
397	1	Earthing set (refer enclosed drawings)
386	2	165mm dia anti climbing device (refer enclosed drawing)
505	2	2.6m long cross arm IMC 100x50
395	3	Aluminium Binding wire 3.66mm
369	6	MV Stay Assembly Complete
330	6	HDG Hex Nut M10
325	6	PG Clamp suitable for ACSR Dog, 3-bolt Type
316	6	HDG Pistol Grip Tension Clamp 70kN-suitable for Dog
309	6	HDG Socket EYE 70kN
305	3	HDG Eye Nut M20 70kN
302	3	HDG Clevis Bolt M20x350mm 70kN c/w 4 nuts & 2 RF washers
201	8	11KV INSULATOR PIN
202	1	ADSS
191	1	Danger Plate
190	1	Pole & Line Nr. Plate
102	2	410-SP72 SWAGGED POLE 13M LENGTH
43	6	11kv, 45KN Polymer strain Insulator

A3	M3		R3D	R3N	Drawn	04.07.24	SS	Client- RAGHUGANGA POWER LIMITED	
A2	M2		R2D	R2N	Check	04.07.24	AKS	Plant- RAGHUGHAT HYDRO ELECTRIC PROJECT(2X20MW)	
A1	M1		R1D	R1N	Appr.			Project-No. OR	
A/M	Modification		Date	Des.	Scale		SC	File/Date MO	FI

CAD A3ST02

BHEL

TITLE :
30-60 d double poles with stay
D/C with strain insulator

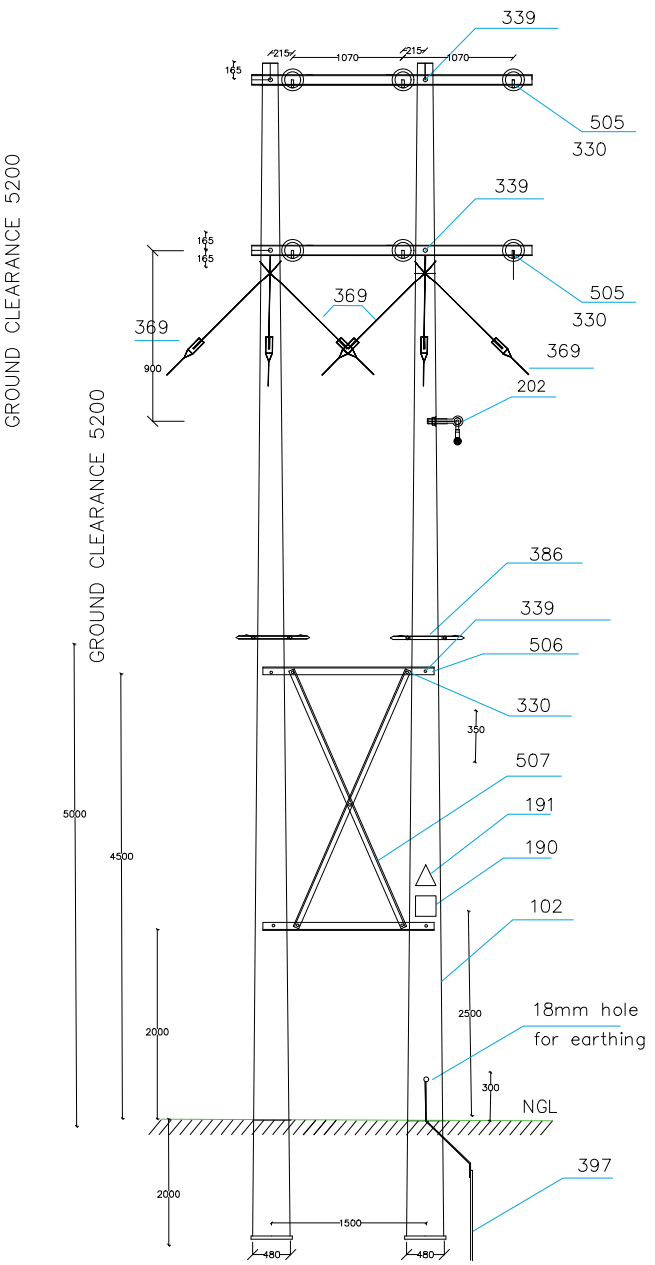
Int. N° =FU PLN +LO

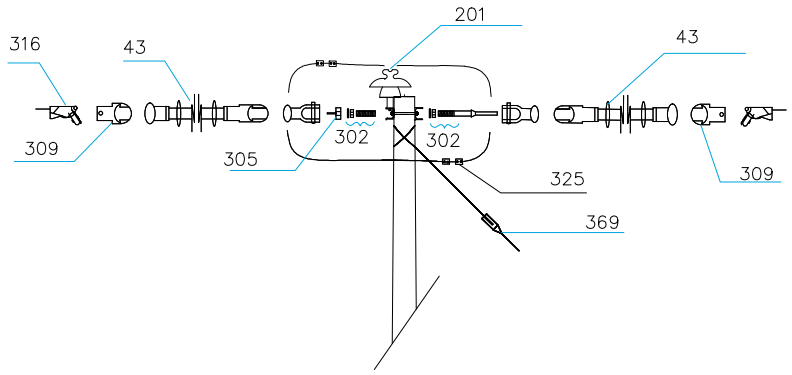
Draw. N° TDC/BHEL/RHP/KED/09

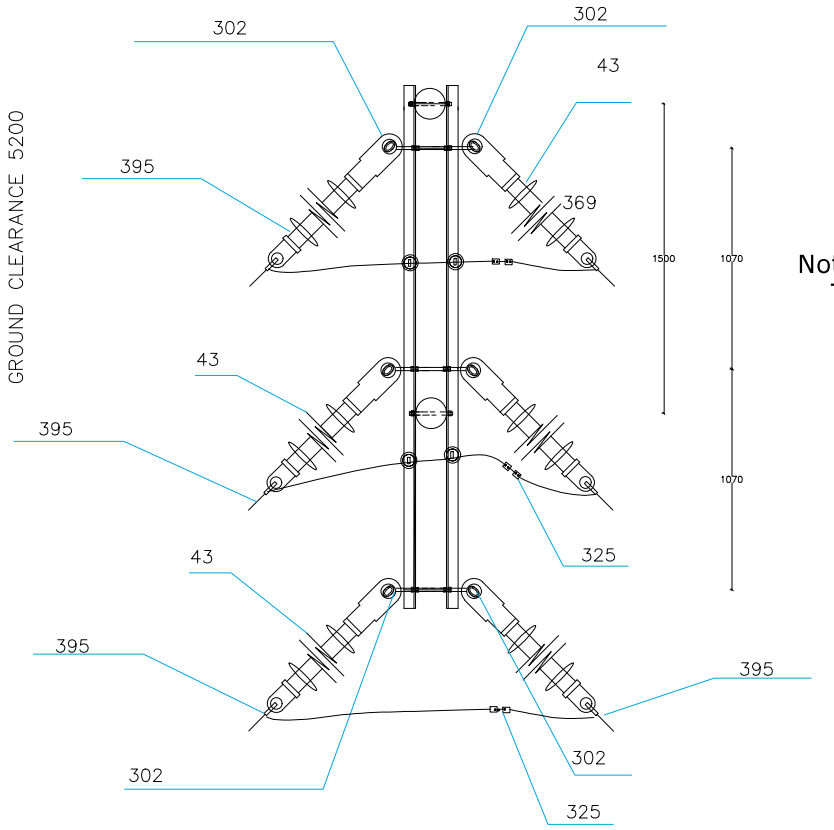
Index RE

Bl./Sht. von/of S2

A3







Note:
To be used for single circuit (S/C)
13m double pole Deviation angle 60-90d

Item	Qty	Description
505	2	2.6m long cross arm IMC 100x50
507	2	Bracing angle L 60x60x6mm
506	2	Belting angle L 60x60x6mm
397	1	Earthing set
386	2	165mm dia anti climbing device
395	3	Aluminium Binding wire 3.66mm
369	2	MV Stay Assembly Complete
325	6	PG Clamp suitable for ACSR Dog, 3-bolt Type
330	6	HDG Hex Nut M10
316	3	HDG Pistol Grip Tension Clamp 70kN-suitable for Dog
309	6	HDG Socket EYE 70kN
302	3	HDG Clevis Bolt M20x250 70KN c/w 2 nuts & 2 RF washers
330	6	HDG Hex Nut M10
191	1	Danger Plate
190	1	Pole & Line Nr. Plate
101	2	410-SP72 SWAGGED POLE 13M LENGTH
43	3	11kv, 45KN Polymer strain Insulator
201	4	Pin Insulator
202	1	ADSS

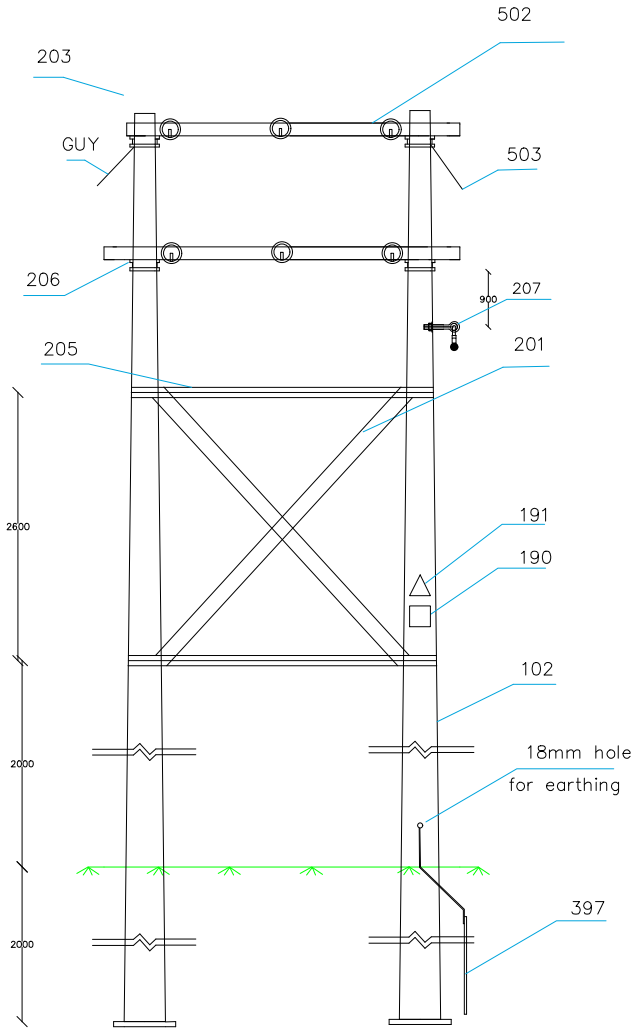
A3	M3		R3D	R3N	Drawn	04.07.24	SS	Client- RAGHUGANGA POWER LIMITED
A2	M2		R2D	R2N	Check	04.07.24	AKS	Plant- RAGHUGHAT HYDRO ELECTRIC PROJECT(2X20MW)
A1	M1		R1D	R1N	Appr.			Project-No. OR
A/M	Modification		Date	Des.	Scale		SC	File/Date MO FI

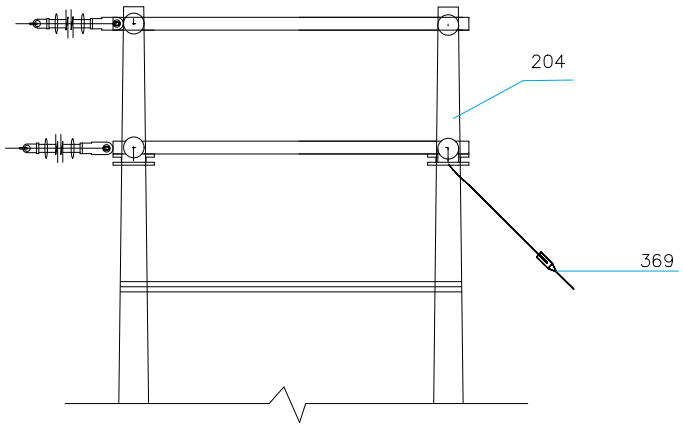
TITLE :
Deviation angle 60-90d
S/C with strain insulator

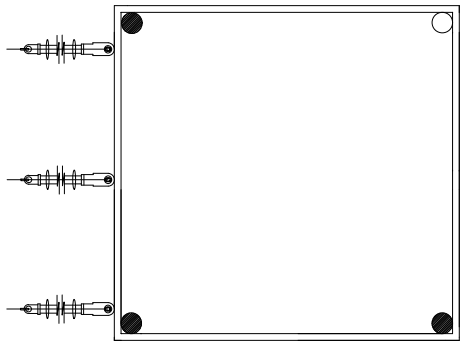
Int. N° | =FU PLN | +LO

Draw. N° TDC/BHEL/RHP/KED/10 | Index RE | Bl./Sht. S1 von/of S2 | A3

CAD A3ST02







Note:
To be used for double circuit (D/C)
13m four pole Dead End assembly

Item	Qty	Description	Remarks
502	6	M.S Channel 100x50x5	
503	8	MV Stay Assembly Complete	
201	8	Bracing angle L 60x60x6mm	
202	apr.	Nut, Bolt, pole clamps(as required)	
203	3	Post Insulator 11kV Basic Insulator 250KVP	
204	12	11kv, 45KN Polymer strain Insulator	
205	8	Belt (60x60x5)	
206	4	Base Plate	
207	1	ADSS	
190	1	Danger Plate	
191	1	Pole & Line Number Plate	
102	4	410-SP72 SWAGGED POLE 13M LENGTH	

A3	M3	R3D	R3N	Drawn	04.07.24	SS	Client- RAGHUGANGA POWER LIMITED
A2	M2	R2D	R2N	Check	04.07.24	AKS	Plant- RAGHUGHAT HYDRO ELECTRIC PROJECT(2X20MW)
A1	M1	R1D	R1N	Appr.			Project-No.
A/M	Modification	Date	Des.	Scale		SC	File/Date MO FI

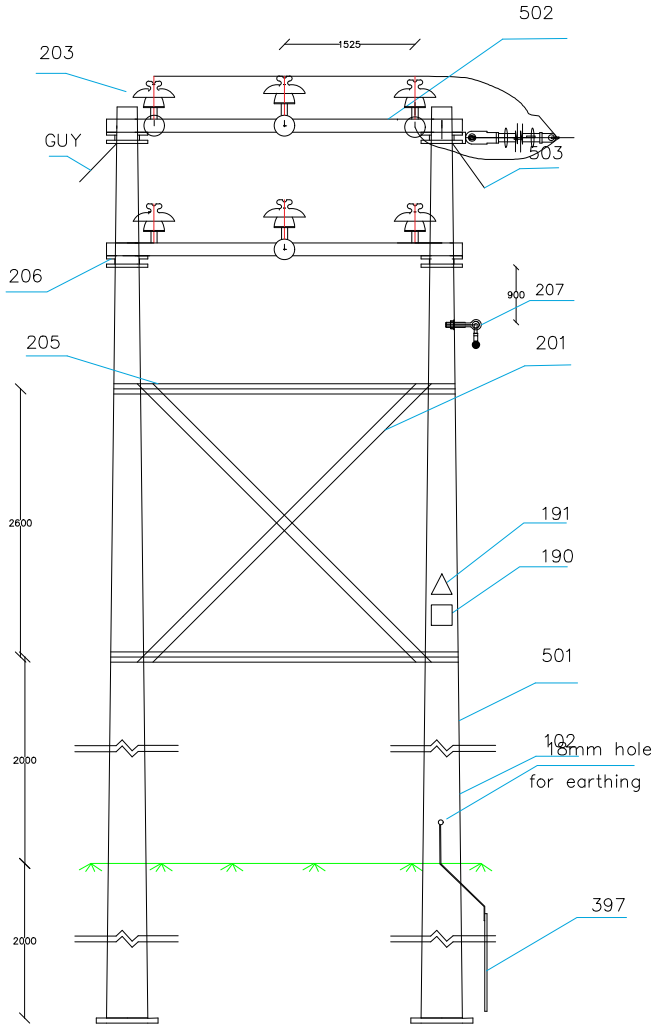
TITLE :
Dead End four poles assembly
D/C with strain insulator

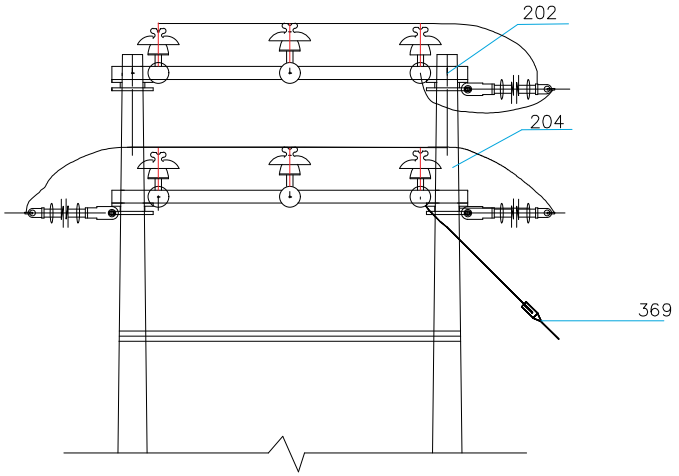
Int. N° =FU PLN +LO

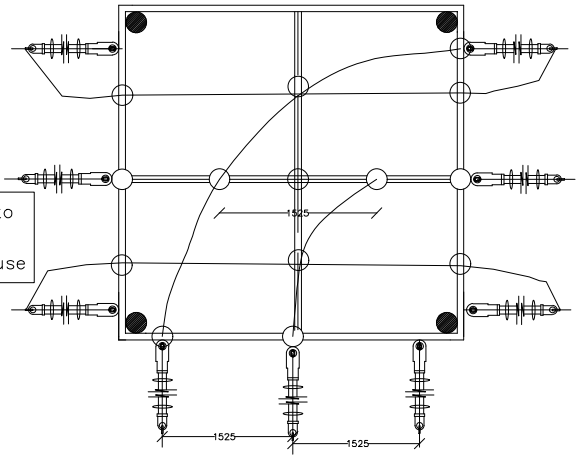
Draw. N° TDC/BHEL/RHP/KED/11

Index RE Bl./Sht. S1 von/of S2 A3

CAD A3ST02







Circuit 1 to Auxiliary Power House

Circuit 1 & 2 from Power House

Circuit 2 to Colony Area

Note:
To be used as intermediate pole for merging circuit 1 and circuit 2

Item	Qty	Description	Remarks
502	4	M.S Channel 100x50x5	
503	8	Guy Set	
397	apr.	Earthing material (as required)	
201	8	Bracing angle L 60x60x6mm	
202	apr.	Nut,Bolt,pole clamps(as required)	
203	21	Post Insulator 11kV Basic Insulator 250KVP	
204	12	Long Rod Composite Insulator 11kV basic insulator 250KVP	
205	8	Belt (65x65x6)	
206	4	Base Plate	
207	1	ADSS	
190	1	Danger Plate	
191	1	Pole & Line Number Plate	
102	4	410-SP72 SWAGGED POLE 13M LENGTH	

A3	M3	R3D	R3N	Drawn	04.07.24	SS	Client- RAGHUGANGA POWER LIMITED	
A2	M2	R2D	R2N	Check	04.07.24	AKS	Plant- RAGHUGHAT HYDRO ELECTRIC PROJECT(2X20MW)	
A1	M1	R1D	R1N	Appr.			Project-No. OR	
A/M	Modification	Date	Des.	Scale		SC	File/Date MO	FI

TITLE :
Intermediate four poles assembly
D/C with strain insulator

Int. N°

=FU PLN
+LO

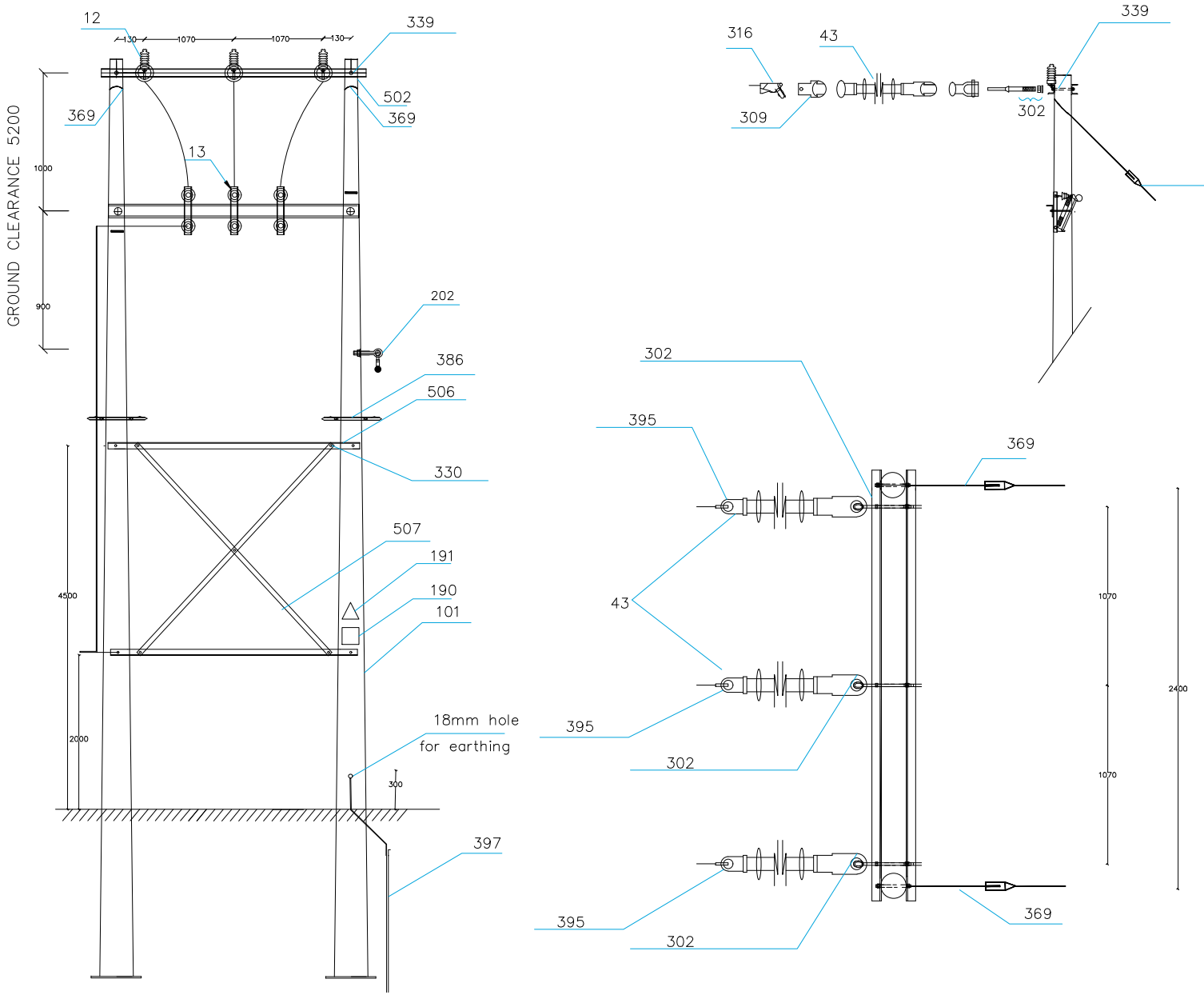
Draw. N° TDC/BHEL/RHP/KED/12

Index RE

Bl./Sht. S1 von/of S2

A3

CAD A3S102



Note:
To be used for single circuit (S/C)
11m double pole Dead End assembly

Item	Qty	Description
507	2	Bracing angle L 60x60x6mm
506	2	Belting angle L 60x60x6mm
397	1	Earthing set
386	2	165mm dia anti climbing device
502	2	2.6m long cross arm IMC 100x50
395	3	Aluminium Binding wire 3.66mm
369	2	MV Stay Assembly Complete
330	6	HDG Hex Nut M10
316	3	HDG Pistol Grip Tension Clamp 70kN-suitable for Dog
309	6	HDG Socket EYE 70kN
302	3	HDG Clevis Bolt M20x250 70KN c/w 2 nuts & 2 RF washers
202	1	ADSS
191	1	Danger Plate
190	1	Pole & Line Nr. Plate
101	2	410-SP55 SWAGGED POLE 11M LENGTH
43	3	11kv, 45KN Polymer strain Insulator
12	1	Lightening Arrestor LA-11kV, 10kA
13	1	Air Break Disconnecting Switch-11kV, 400A

A3	M3	R3D	R3N	Drawn	04.07.24	SS	Client- RAGHUGANGA POWER LIMITED
A2	M2	R2D	R2N	Check	04.07.24	AKS	Plant- RAGHUGHAT HYDRO ELECTRIC PROJECT(2X20MW)
A1	M1	R1D	R1N	Appr.			Project-No. OR
A/M	Modification	Date	Des.	Scale		SC	File/Date MO FI

BHEL

TITLE :
Dead End double poles assembly
S/C with strain insulator

Int. N°
=FU PLN
+LO

Draw. N° TDC/BHEL/RHP/KED/13

Index RE

Bl./Sht. S1
von/of S2

A3

PROJECT	2x20MW RAGHUGHAT HYDRO ELECTRIC PROJECT	
COSTOMER	RAGHUGANGA POWER PROJECT, NEPAL	
EPC CONTRACTOR	BHARAT HEAVY ELECTRICAL LTD. TRANSMISSION PROJECTS DIVISION	
TITLE	ROUTE ALIGNMNET AND DESIGN ENGINEERING OF 11kV OHL DISTRIBUTION LINES	S/C

FOUNDATION DESIGN OF 11KV POLE STRUCTURE

(SINGLE CIRCUIT TRANSMISSION LINE)

Rev. no.	Prepared by	Prepared Date	Checked By	Checked Date	Approved By	Approved Date	Remarks
0	AK	15.07.24	AKS	15.07.24			

	Project Name : 11kV Distribution for Raghughat Hydro Power Project	
	DESIGN OF POLE FOUNDATION	
	`	**S/C Pole**
S.N	**Pole Type**	**0d**
A	For cohesionless soils, **Broms' procedure** may be used as per following equations, from which the required embedment length L can be found. Alternatively, if embedment length is given, Diameter D of foundation may be calculated.	
	Equation $L^3 - 2H_f L / K_p \gamma D * L - 2M_f / K_p \gamma D = 0$	
	in which $K_P = \{\tan(45+Fi/2)\}2$	
	Where D = shaft diameter / foundation diameter	
	Fi= Angle of repose	
	γ = Effectice density of soil	
	M_f = factored moment at ground line	
	H_f = Factored shear force at ground	
	Appiled load at pole at ground	
B	Load applied at pole at ground level (from PLS-pole calculations) maximum of each load case taken	
	Resultant moment at ground level M (kN-m)	39.02
	Shear force at ground level H (KN)	5.36
	Axial force V (N)	4.42
	Above loads are overloaded by a factor of 1.5 in PLS-Pole. Further, using a under capacity factor of 1.1 on above, ultimate factored load will be	
	Factored moment Mf (kN-m)	42.92
	Factored shear Force Hf (KN)	5.90
	Factored Axial Vf(KN)	4.86
C	**Physical parameters of Poles**	
	Diameter of pole at ground level d	0.165
	Embedment length L (m)	1.70

	Project Name : 11kV Distribution for Raghughat Hydro Power Project	
	DESIGN OF POLE FOUNDATION	
	`	**S/C Pole**
S.N	**Pole Type**	**0d**
D	**Soil Parameter**	
	Bulk Density of Soil g_b kN/cum	15
	Angle of Friction Fi	25
	Safe Bearing Capacity of soil	10
E	**Check against Vertical load**	
	Resisting Load from end bearing	3
	Resisting Bearing Load from skin friction	28
	Total resisting load	**31**
		ok
F	**Calculation of Diameter of foundation**	
	Equivalent eccentricity e = Mf/ Hf	7.280
	KP = {tan (45+Fi/2)}2	2.464
	Factor 2Hf / Kp r D	0.542
	Factor 2Mf /Kp r D	2.323
	Equation L^3 - 2Hf L / Kp r D * L - 2Mf /Kp g D = 0 Trial with value 'D' to get 0	0.057
	Required diameter of concrete pipe / plastic pipe	**0.590**
G	**Recommended dia of pole foundation**	
	Recommended dia of excavation /concrete /plastic pipe (m)	**0.590**

Project Name : 11kV Distribution for Raghughat Hydro Power Project

DESIGN OF POLE FOUNDATION

		S/C Pole
S.N	**Pole Type**	**0-10d**
A	For cohesionless soils, **Broms' procedure** may be used as per following equations, from which the required embedment length L can be found. Alternatively, if embedment length is given, Diameter D of foundation may be calculated.	
	Equation $L^3 - 2H_f L / K_p \gamma D * L - 2M_f / K_p \gamma D = 0$	
	in which $K_p = \{\tan(45+Fi/2)\}2$	
	Where D = shaft diameter / foundation diameter	
	Fi= Angle of repose	
	γ = Effectice density of soil	
	M_f = factored moment at ground line	
	H_f = Factored shear force at ground	
	Appiled load at pole at ground	
B	Load applied at pole at ground level (from PLS-pole calculations) maximum of each load case taken	
	Resultant moment at ground level M (kN-m)	24.54
	Shear force at ground level H (KN)	2.99
	Axial force V (N)	19.21
	Above loads are overloaded by a factor of 1.5 in PLS-Pole. Further, using a under capacity factor of 1.1 on above, ultimate factored load will be	
	Factored moment Mf (kN-m)	26.99
	Factored shear Force Hf (KN)	3.29
	Factored Axial Vf(KN)	21.13
C	**Physical parameters of Poles**	
	Diameter of pole at ground level d	0.165
	Embedment length L (m)	1.70

	Project Name : 11kV Distribution for Raghughat Hydro Power Project	
	DESIGN OF POLE FOUNDATION	
		S/C Pole
S.N	**Pole Type**	**0-10d**
D	**Soil Parameter**	
	Bulk Density of Soil g_b kN/cum	15
	Angle of Friction Fi	25
	Safe Bearing Capacity of soil	10
E	**Check against Vertical load**	
	Resisting Load from end bearing	1
	Resisting Bearing Load from skin friction	20
	Total resisting load	**21**
		ok
F	**Calculation of Diameter of foundation**	
	Equivalent eccentricity e = Mf/ Hf	8.207
	KP = {tan (45+Fi/2)}2	2.464
	Factor 2Hf / Kp r D	0.303
	Factor 2Mf /Kp r D	1.461
	Equation L^3 - 2Hf L / Kp r D * L - 2Mf /Kp g D = 0 Trial with value 'D' to get 0	0.015
	Required diameter of concrete pipe / plastic pipe	**0.360**
G	**Recommended dia of pole foundation**	
	Recommended dia of excavation /concrete /plastic pipe (m)	**0.420**

Project Name : 11kV Distribution for Raghughat Hydro Power Project

DESIGN OF POLE FOUNDATION

		S/C Pole
S.N	**Pole Type**	**10-30d**
A	For cohesionless soils, **Broms' procedure** may be used as per following equations, from which the required embedment length L can be found. Alternatively, if embedment length is given, Diameter D of foundation may be calculated.	
	Equation $L^3 - 2H_f L / K_p \gamma D * L - 2M_f / K_p \gamma D = 0$	
	in which $K_p = \{\tan(45+Fi/2)\}2$	
	Where D = shaft diameter / foundation diameter	
	Fi= Angle of repose	
	γ = Effectice density of soil	
	M_f = factored moment at ground line	
	H_f = Factored shear force at ground	
	Appiled load at pole at ground	
B	Load applied at pole at ground level (from PLS-pole calculations) maximum of each load case taken	
	Resultant moment at ground level M (kN-m)	14.16
	Shear force at ground level H (KN)	3.64
	Axial force V (N)	42.35
	Above loads are overloaded by a factor of 1.5 in PLS-Pole. Further, using a under capacity factor of 1.1 on above, ultimate factored load will be	
	Factored moment Mf (kN-m)	15.58
	Factored shear Force Hf (KN)	4.00
	Factored Axial Vf(KN)	46.59
C	**Physical parameters of Poles**	
	Diameter of pole at ground level d	0.165
	Embedment length L (m)	1.70

Project Name : 11kV Distribution for Raghughat Hydro Power Project

DESIGN OF POLE FOUNDATION

		S/C Pole
S.N	**Pole Type**	**10-30d**
D	**Soil Parameter**	
	Bulk Density of Soil g_b kN/cum	15
	Angle of Friction Fi	25
	Safe Bearing Capacity of soil	10
E	**Check against Vertical load**	
	Resisting Load from end bearing	6
	Resisting Bearing Load from skin friction	41
	Total resisting load	**47**
		ok
F	**Calculation of Diameter of foundation**	
	Equivalent eccentricity e = Mf/ Hf	3.890
	KP = {tan (45+Fi/2)}2	2.464
	Factor 2Hf / Kp r D	0.368
	Factor 2Mf /Kp r D	0.843
	Equation L^3 - 2Hf L / Kp r D * L - 2Mf /Kp g D = 0 Trial with value 'D' to get 0	0.068
	Required diameter of concrete pipe / plastic pipe	**0.250**
G	**Recommended dia of pole foundation**	
	Recommended dia of excavation /concrete /plastic pipe (m)	**0.860**

	Project Name : 11kV Distribution for Raghughat Hydro Power Project	
	DESIGN OF POLE FOUNDATION	
		S/C Pole
S.N	**Pole Type**	**30-60d**
A	For cohesionless soils, **Broms' procedure** may be used as per following equations, from which the required embedment length L can be found. Alternatively, if embedment length is given, Diameter D of foundation may be calculated.	
	Equation $L^3 - 2H_f L / K_p \gamma D * L - 2M_f / K_p \gamma D = 0$	
	in which $K_p = \{\tan(45+Fi/2)\}2$	
	Where D = shaft diameter / foundation diameter	
	Fi= Angle of repose	
	γ = Effectice density of soil	
	M_f = factored moment at ground line	
	H_f = Factored shear force at ground	
	Appiled load at pole at ground	
B	Load applied at pole at ground level (from PLS-pole calculations) maximum of each load case taken	
	Resultant moment at ground level M (kN-m)	19.00
	Shear force at ground level H (KN)	3.75
	Axial force V (N)	30.13
	Above loads are overloaded by a factor of 1.5 in PLS-Pole. Further, using a under capacity factor of 1.1 on above, ultimate factored load will be	
	Factored moment Mf (kN-m)	20.90
	Factored shear Force Hf (KN)	4.13
	Factored Axial Vf(KN)	33.14
C	**Physical parameters of Poles**	
	Diameter of pole at ground level d	0.165
	Embedment length L (m)	1.70

Project Name : 11kV Distribution for Raghughat Hydro Power Project

DESIGN OF POLE FOUNDATION

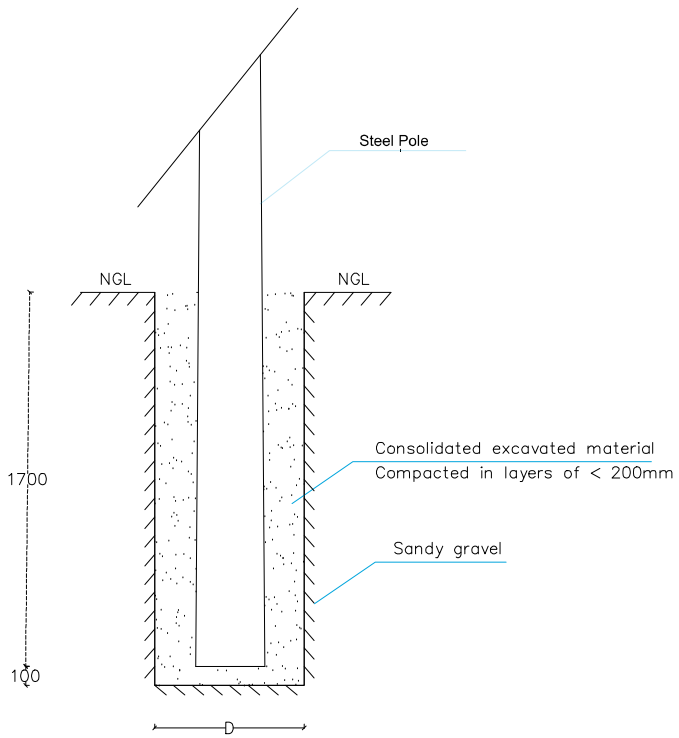
		S/C Pole
S.N	**Pole Type**	**30-60d**
D	**Soil Parameter**	
	Bulk Density of Soil g_b kN/cum	15
	Angle of Friction Fi	25
	Safe Bearing Capacity of soil	10
E	**Check against Vertical load**	
	Resisting Load from end bearing	3
	Resisting Bearing Load from skin friction	30
	Total resisting load	**34**
		ok
F	**Calculation of Diameter of foundation**	
	Equivalent eccentricity e = Mf/ Hf	5.067
	KP = {tan (45+Fi/2)}2	2.464
	Factor 2Hf / Kp r D	0.379
	Factor 2Mf /Kp r D	1.131
	Equation L^3 - 2Hf L / Kp r D * L - 2Mf /Kp g D = 0 Trial with value 'D' to get 0	0.041
	Required diameter of concrete pipe / plastic pipe	**0.310**
G	**Recommended dia of pole foundation**	
	Recommended dia of excavation /concrete /plastic pipe (m)	**0.640**

	Project Name : 11kV Distribution for Raghughat Hydro Power Project	
	DESIGN OF POLE FOUNDATION	
		S/C Pole
S.N	**Pole Type**	**60-90d**
A	For cohesionless soils, **Broms' procedure** may be used as per following equations, from which the required embedment length L can be found. Alternatively, if embedment length is given, Diameter D of foundation may be calculated.	
	Equation $L^3 - 2H_f L / K_p \gamma D * L - 2M_f / K_p \gamma D = 0$	
	in which $K_p = \{\tan(45+Fi/2)\}2$	
	Where D = shaft diameter / foundation diameter	
	Fi= Angle of repose	
	γ = Effectice density of soil	
	M_f = factored moment at ground line	
	H_f = Factored shear force at ground	
	Appiled load at pole at ground	
B	Load applied at pole at ground level (from PLS-pole calculations) maximum of each load case taken	
	Resultant moment at ground level M (kN-m)	17.63
	Shear force at ground level H (KN)	2.18
	Axial force V (N)	19.75
	Above loads are overloaded by a factor of 1.5 in PLS-Pole. Further, using a under capacity factor of 1.1 on above, ultimate factored load will be	
	Factored moment Mf (kN-m)	19.39
	Factored shear Force Hf (KN)	2.40
	Factored Axial Vf(KN)	21.73
C	**Physical parameters of Poles**	
	Diameter of pole at ground level d	0.165
	Embedment length L (m)	1.70

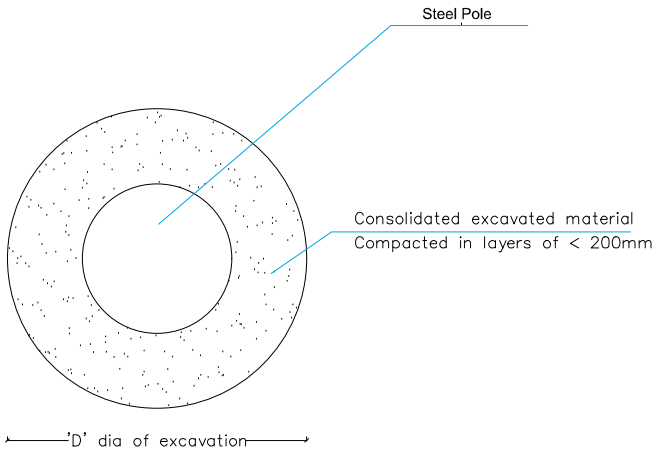
	Project Name : 11kV Distribution for Raghughat Hydro Power Project	
	DESIGN OF POLE FOUNDATION	
		S/C Pole
S.N	**Pole Type**	**60-90d**
D	**Soil Parameter**	
	Bulk Density of Soil g_b kN/cum	15
	Angle of Friction Fi	25
	Safe Bearing Capacity of soil	10
E	**Check against Vertical load**	
	Resisting Load from end bearing	2
	Resisting Bearing Load from skin friction	21
	Total resisting load	**23**
		ok
F	**Calculation of Diameter of foundation**	
	Equivalent eccentricity e = Mf/ Hf	8.087
	KP = {tan (45+Fi/2)}2	2.464
	Factor 2Hf / Kp r D	0.221
	Factor 2Mf /Kp r D	1.049
	Equation L^3 - 2Hf L / Kp r D * L - 2Mf /Kp g D = 0 Trial with value 'D' to get 0	0.028
	Required diameter of concrete pipe / plastic pipe	**0.260**
G	**Recommended dia of pole foundation**	
	Recommended dia of excavation /concrete /plastic pipe (m)	**0.450**

	Project Name : 11kV Distribution for Raghughat Hydro Power Project	
	DESIGN OF POLE FOUNDATION	
		S/C Pole
S.N	**Pole Type**	**Dead End**
A	For cohesionless soils, **Broms' procedure** may be used as per following equations, from which the required embedment length L can be found. Alternatively, if embedment length is given, Diameter D of foundation may be calculated.	
	Equation $L^3 - 2H_f L / K_p \gamma D * L - 2M_f / K_p \gamma D = 0$	
	in which $K_p = \{\tan(45+Fi/2)\}2$	
	Where D = shaft diameter / foundation diameter	
	Fi= Angle of repose	
	γ = Effectice density of soil	
	M_f = factored moment at ground line	
	H_f = Factored shear force at ground	
	Appiled load at pole at ground	
B	Load applied at pole at ground level (from PLS-pole calculations) maximum of each load case taken	
	Resultant moment at ground level M (kN-m)	23.09
	Shear force at ground level H (KN)	1.04
	Axial force V (N)	29.24
	Above loads are overloaded by a factor of 1.5 in PLS-Pole. Further, using a under capacity factor of 1.1 on above, ultimate factored load will be	
	Factored moment Mf (kN-m)	25.40
	Factored shear Force Hf (KN)	1.14
	Factored Axial Vf(KN)	32.16
C	**Physical parameters of Poles**	
	Diameter of pole at ground level d	0.165
	Embedment length L (m)	1.70

	Project Name : 11kV Distribution for Raghughat Hydro Power Project	
	DESIGN OF POLE FOUNDATION	
		S/C Pole
S.N	**Pole Type**	**Dead End**
D	**Soil Parameter**	
	Bulk Density of Soil g_b kN/cum	15
	Angle of Friction Fi	25
	Safe Bearing Capacity of soil	10
E	**Check against Vertical load**	
	Resisting Load from end bearing	3
	Resisting Bearing Load from skin friction	30
	Total resisting load	**33**
		ok
F	**Calculation of Diameter of foundation**	
	Equivalent eccentricity e = Mf/ Hf	22.202
	KP = {tan (45+Fi/2)}2	2.464
	Factor 2Hf / Kp r D	0.105
	Factor 2Mf /Kp r D	1.374
	Equation L^3 - 2Hf L / Kp r D * L - 2Mf /Kp g D = 0 Trial with value 'D' to get 0	0.062
	Required diameter of concrete pipe / plastic pipe	**0.305**
G	**Recommended dia of pole foundation**	
	Recommended dia of excavation /concrete /plastic pipe (m)	**0.620**



SIDE VIEW



PLAN VIEW

Pole Type	Description	Excavation Dia 'D'
SP	Intermediate pole	0.590 m
SP/SS	Single pole single stay pin insu	0.420 m
SP/DS	Single pole double stay string	0.860 m
DP/DS	Double pole double stay string	0.640 m
DP/DS	Double pole double stay string	0.450 m
DP/DS-E	Double pole double stay	0.620 m

REV. No.	DATE	MECH.	CIVIL	ELEC.	RE	DESCRIPTION
		CHECKED				

CLIENT: RAGHUGANGA POWER LIMITED

CONTRACTOR: BHARAT HEAVY ELECTRICALS LTD.

CONSULTANT: THE DESIGNERS CONSORTIUM
A-435 LOGIX TECHNOVA SECTOR 132, NOIDA -04
Ph: 0120 4176259, 9958233117
e-mail : rks@tdcind.com
web : www.tdcind.co.in

CONTRACT NO :		PROJECT : RAGHUGHAT HYDRO ELECTRIC PROJECT(2X20MW)
PREPARED	NAME	DATE
DRAWN BY	SS	04.07.24
DESIGNED BY	AK	04.07.24
CHECKED BY	AKS	04.07.24
APPROVED BY		DRAWING TITLE : FOUNDATION DRAWING OF SINGLE CIRCUIT POLES
SHEET SIZE	A1	DRAWING NO : TDC/BHEL/RHP/FD/01 REV. 00 SHEET 01
SCALE	1:10000	

PROJECT	**2x20MW RAGHUGHAT HYDRO ELECTRIC PROJECT**	
COSTOMER	**RAGHUGANGA POWER PROJECT, NEPAL**	
EPC CONTRACTOR	**BHARAT HEAVY ELECTRICAL LTD. TRANSMISSION PROJECTS DIVISION**	
TITLE :	**ROUTE ALIGNMNET AND DESIGN ENGINEERING OF 11kV OHL DISTRIBUTION LINES**	LONG SPAN

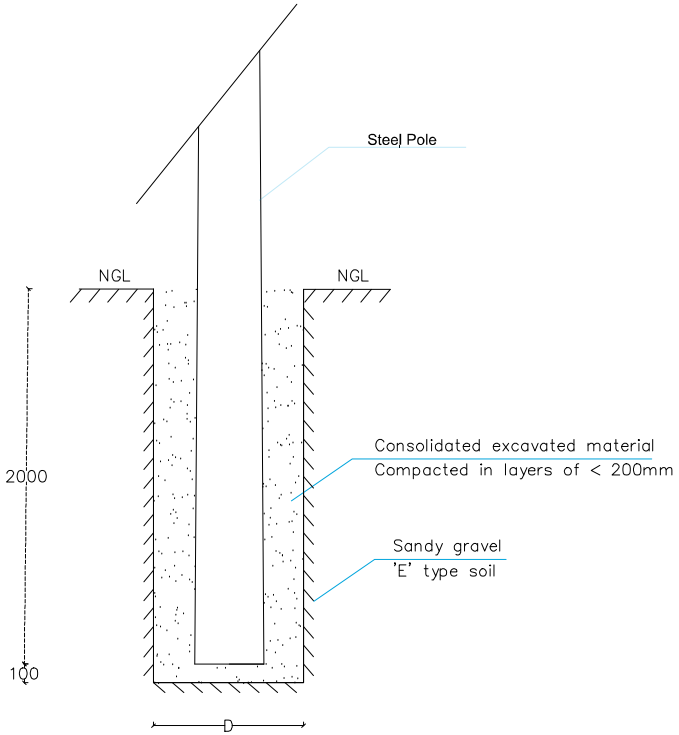
FOUNDATION DESIGN OF 11KV POLE STRUCTURE

(SINGLE CIRCUIT LONG SPAN)

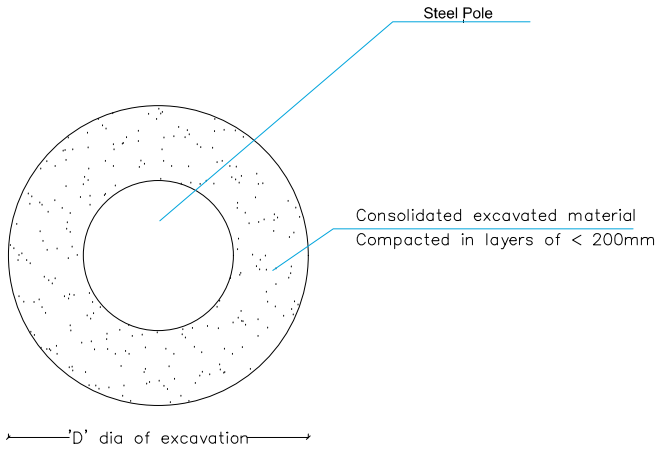
0	AK	15.07.24	AKS	15.07.24			
Rev. no.	**Prepared by**	**Prepared Date**	**Checked By**	**Checked Date**	**Approved By**	**Approved Date**	**Remarks**

	Project Name : 11kV Distribution for Raghughat Hydro Power Project	
	DESIGN OF POLE FOUNDATION	
	`	**S/C Pole**
S.N	**Pole Type**	**Long Span**
A	For cohesionless soils, **Broms' procedure** may be used as per following equations, from which the required embedment length L can be found. Alternatively, if embedment length is given, Diameter D of foundation may be calculated.	
	Equation $L^3 - 2H_f L / K_p \gamma D * L - 2M_f / K_p \gamma D = 0$	
	in which $K_P = \{\tan(45+Fi/2)\}2$	
	Where D = shaft diameter / foundation diameter	
	Fi= Angle of repose	
	γ = Effectice density of soil	
	M_f = factored moment at ground line	
	H_f = Factored shear force at ground	
	Appiled load at pole at ground	
B	Load applied at pole at ground level (from PLS-pole calculations) maximum of each load case taken	
	Resultant moment at ground level M (kN-m)	9.60
	Shear force at ground level H (KN)	1.04
	Axial force V (N)	9.60
	Above loads are overloaded by a factor of 1.5 in PLS-Pole. Further, using a under capacity factor of 1.1 on above, ultimate factored load will be	
	Factored moment Mf (kN-m)	10.56
	Factored shear Force Hf (KN)	1.14
	Factored Axial Vf(KN)	10.56
C	**Physical parameters of Poles**	
	Diameter of pole at ground level d	0.219
	Embedment length L (m)	1.70

	Project Name : 11kV Distribution for Raghughat Hydro Power Project	
	DESIGN OF POLE FOUNDATION	
	`	S/C Pole
S.N	Pole Type	Long Span
D	**Soil Parameter**	
	Bulk Density of Soil g_b kN/cum	15
	Angle of Friction Fi	25
	Safe Bearing Capacity of soil	10
E	**Check against Vertical load**	
	Resisting Load from end bearing	2
	Resisting Bearing Load from skin friction	24
	Total resisting load	**26**
		ok
F	**Calculation of Diameter of foundation**	
	Equivalent eccentricity e = Mf/ Hf	9.231
	KP = {tan (45+Fi/2)}2	2.464
	Factor 2Hf / Kp r D	0.105
	Factor 2Mf /Kp r D	0.571
	Equation L^3 - 2Hf L / Kp r D * L - 2Mf /Kp g D = 0 Trial with value 'D' to get 0	1.823
	Required diameter of concrete pipe / plastic pipe	**0.219**
G	**Recommended dia of pole foundation**	
	Recommended dia of excavation /concrete /plastic pipe (m)	**0.500**



SIDE VIEW



PLAN VIEW

Pole Type	Description	Excavation Dia 'D'
DP/FS	Long span double pole four stay	0.500 m

REV. No.	DATE	MECH.	CIVIL	ELEC.	RE	DESCRIPTION
		CHECKED				

CLIENT: RAGHUGANGA POWER LIMITED

CONTRACTOR: BHARAT HEAVY ELECTRICALS LTD.

CONSULTANT: THE DESIGNERS CONSORTIUM
A-435 LOGIX TECHNOVA SECTOR 132, NOIDA -04
Ph: 0120 4176259, 9958233117
e-mail : rks@tdcind.com
web : www.tdcind.co.in

CONTRACT NO :			PROJECT : RAGHUGHAT HYDRO ELECTRIC PROJECT(2X20MW)
PREPARED	NAME	DATE	
DRAWN BY	SS	04.07.24	
DESIGNED BY	AK	04.07.24	DRAWING TITLE : FOUNDATION DRAWING OF LONG SPAN POLES
CHECKED BY	AKS	04.07.24	
APPROVED BY			
SHEET SIZE	A1		DRAWING NO : TDC/BHEL/RHP/FD/03 — REV. 00 — SHEET 01
SCALE	1:10000		

PROJECT	**2x20MW RAGHUGHAT HYDRO ELECTRIC PROJECT**	
COSTOMER	**RAGHUGANGA POWER PROJECT, NEPAL**	
EPC CONTRACTOR	**BHARAT HEAVY ELECTRICAL LTD. TRANSMISSION PROJECTS DIVISION**	
TITLE :	**ROUTE ALIGNMNET AND DESIGN ENGINEERING OF 11kV OHL DISTRIBUTION LINES**	

FOUNDATION DESIGN OF 11KV POLE STRUCTURE

(DOUBLE CIRCUIT 11kV TRANSMISSION LINE)

0	AK	15.07.24	AKS	15.07.24			
Rev. no.	**Prepared by**	**Prepared Date**	**Checked By**	**Checked Date**	**Approved By**	**Approved Date**	**Remarks**

	Project Name : 11kV Distribution for Raghughat Hydro Power Project	
	DESIGN OF POLE FOUNDATION	
	`	D/C Pole
S.N	Pole Type	0d
A	For cohesionless soils, **Broms' procedure** may be used as per following equations, from which the required embedment length L can be found. Alternatively, if embedment length is given, Diameter D of foundation may be calculated.	
	Equation $L^3 - 2H_f L / K_p \gamma D * L - 2M_f / K_p \gamma D = 0$	
	in which $K_P = \{\tan(45+Fi/2)\}2$	
	Where D = shaft diameter / foundation diameter	
	Fi= Angle of repose	
	γ = Effectice density of soil	
	M_f = factored moment at ground line	
	H_f = Factored shear force at ground	
	Appiled load at pole at ground	
B	Load applied at pole at ground level (from PLS-pole calculations) maximum of each load case taken	
	Resultant moment at ground level M (kN-m)	82.29
	Shear force at ground level H (KN)	9.94
	Axial force V (N)	8.59
	Above loads are overloaded by a factor of 1.5 in PLS-Pole. Further, using a under capacity factor of 1.1 on above, ultimate factored load will be	
	Factored moment Mf (kN-m)	90.52
	Factored shear Force Hf (KN)	10.93
	Factored Axial Vf(KN)	9.45
C	**Physical parameters of Poles**	
	Diameter of pole at ground level d	0.165
	Embedment length L (m)	1.70

	Project Name : 11kV Distribution for Raghughat Hydro Power Project	
	DESIGN OF POLE FOUNDATION	
	`	D/C Pole
S.N	Pole Type	0d
D	**Soil Parameter**	
	Bulk Density of Soil g_b kN/cum	15
	Angle of Friction Fi	25
	Safe Bearing Capacity of soil	10
E	**Check against Vertical load**	
	Resisting Load from end bearing	11
	Resisting Bearing Load from skin friction	58
	Total resisting load	**69**
		ok
F	**Calculation of Diameter of foundation**	
	Equivalent eccentricity e = Mf/ Hf	8.279
	KP = {tan (45+Fi/2)}2	2.464
	Factor 2Hf / Kp r D	1.006
	Factor 2Mf /Kp r D	4.898
	Equation L^3 - 2Hf L / Kp r D * L - 2Mf /Kp g D = 0 Trial with value 'D' to get 0	0.033
	Required diameter of concrete pipe / plastic pipe	**1.210**
G	**Recommended dia of pole foundation**	
	Recommended dia of excavation /concrete /plastic pipe (m)	**1.210**

Project Name : 11kV Distribution for Raghughat Hydro Power Project

DESIGN OF POLE FOUNDATION

		D/C Pole
S.N	**Pole Type**	**0-10d**
A	For cohesionless soils, **Broms' procedure** may be used as per following equations, from which the required embedment length L can be found. Alternatively, if embedment length is given, Diameter D of foundation may be calculated.	
	Equation $L^3 - 2H_f L / K_p \gamma D * L - 2M_f / K_p \gamma D = 0$	
	in which $K_p = \{\tan(45+Fi/2)\}2$	
	Where D = shaft diameter / foundation diameter	
	Fi= Angle of repose	
	γ = Effectice density of soil	
	M_f = factored moment at ground line	
	H_f = Factored shear force at ground	
	Appiled load at pole at ground	
B	Load applied at pole at ground level (from PLS-pole calculations) maximum of each load case taken	
	Resultant moment at ground level M (kN-m)	57.60
	Shear force at ground level H (KN)	5.67
	Axial force V (N)	31.39
	Above loads are overloaded by a factor of 1.5 in PLS-Pole. Further, using a under capacity factor of 1.1 on above, ultimate factored load will be	
	Factored moment Mf (kN-m)	63.36
	Factored shear Force Hf (KN)	6.24
	Factored Axial Vf(KN)	34.53
C	**Physical parameters of Poles**	
	Diameter of pole at ground level d	0.165
	Embedment length L (m)	1.70

	Project Name : 11kV Distribution for Raghughat Hydro Power Project	
	DESIGN OF POLE FOUNDATION	
		D/C Pole
S.N	**Pole Type**	**0-10d**
D	**Soil Parameter**	
	Bulk Density of Soil g_b kN/cum	15
	Angle of Friction Fi	25
	Safe Bearing Capacity of soil	10
E	**Check against Vertical load**	
	Resisting Load from end bearing	5
	Resisting Bearing Load from skin friction	40
	Total resisting load	**45**
		ok
F	**Calculation of Diameter of foundation**	
	Equivalent eccentricity e = Mf/ Hf	10.159
	KP = {tan (45+Fi/2)}2	2.464
	Factor 2Hf / Kp r D	0.574
	Factor 2Mf /Kp r D	3.429
	Equation L^3 - 2Hf L / Kp r D * L - 2Mf /Kp g D = 0 Trial with value 'D' to get 0	0.091
	Required diameter of concrete pipe / plastic pipe	**0.830**
G	**Recommended dia of pole foundation**	
	Recommended dia of excavation /concrete /plastic pipe (m)	**0.830**

	Project Name : 11kV Distribution for Raghughat Hydro Power Project	
	DESIGN OF POLE FOUNDATION	
		D/C Pole
S.N	**Pole Type**	**10-30d**
A	For cohesionless soils, **Broms' procedure** may be used as per following equations, from which the required embedment length L can be found. Alternatively, if embedment length is given, Diameter D of foundation may be calculated.	
	Equation $L^3 - 2H_f L / K_p \gamma D * L - 2M_f / K_p \gamma D = 0$	
	in which $K_p = \{\tan(45+Fi/2)\}2$	
	Where D = shaft diameter / foundation diameter	
	Fi= Angle of repose	
	γ = Effectice density of soil	
	M_f = factored moment at ground line	
	H_f = Factored shear force at ground	
	Appiled load at pole at ground	
B	Load applied at pole at ground level (from PLS-pole calculations) maximum of each load case taken	
	Resultant moment at ground level M (kN-m)	36.59
	Shear force at ground level H (KN)	21.13
	Axial force V (N)	70.95
	Above loads are overloaded by a factor of 1.5 in PLS-Pole. Further, using a under capacity factor of 1.1 on above, ultimate factored load will be	
	Factored moment Mf (kN-m)	40.25
	Factored shear Force Hf (KN)	23.24
	Factored Axial Vf(KN)	78.05
C	**Physical parameters of Poles**	
	Diameter of pole at ground level d	0.165
	Embedment length L (m)	1.70

	Project Name : 11kV Distribution for Raghughat Hydro Power Project	
	DESIGN OF POLE FOUNDATION	
		D/C Pole
S.N	**Pole Type**	**10-30d**
D	**Soil Parameter**	
	Bulk Density of Soil g_b kN/cum	15
	Angle of Friction Fi	25
	Safe Bearing Capacity of soil	10
E	**Check against Vertical load**	
	Resisting Load from end bearing	14
	Resisting Bearing Load from skin friction	64
	Total resisting load	**79**
		ok
F	**Calculation of Diameter of foundation**	
	Equivalent eccentricity e = Mf/ Hf	1.732
	KP = {tan (45+Fi/2)}2	2.464
	Factor 2Hf / Kp r D	2.138
	Factor 2Mf /Kp r D	2.178
	Equation L^3 - 2Hf L / Kp r D * L - 2Mf /Kp g D = 0 Trial with value 'D' to get 0	0.008
	Required diameter of concrete pipe / plastic pipe	**0.880**
G	**Recommended dia of pole foundation**	
	Recommended dia of excavation /concrete /plastic pipe (m)	**1.350**

	Project Name : 11kV Distribution for Raghughat Hydro Power Project	
	DESIGN OF POLE FOUNDATION	
		10.120
S.N	**Pole Type**	**30-60d**
A	For cohesionless soils, **Broms' procedure** may be used as per following equations, from which the required embedment length L can be found. Alternatively, if embedment length is given, Diameter D of foundation may be calculated.	
	Equation $L^3 - 2H_f L / K_p \gamma D * L - 2M_f / K_p \gamma D = 0$	
	in which $K_p = \{\tan(45+Fi/2)\}2$	
	Where D = shaft diameter / foundation diameter	
	Fi= Angle of repose	
	γ = Effectice density of soil	
	M_f = factored moment at ground line	
	H_f = Factored shear force at ground	
	Appiled load at pole at ground	
B	Load applied at pole at ground level (from PLS-pole calculations) maximum of each load case taken	
	Resultant moment at ground level M (kN-m)	10.12
	Shear force at ground level H (KN)	2.65
	Axial force V (N)	63.65
	Above loads are overloaded by a factor of 1.5 in PLS-Pole. Further, using a under capacity factor of 1.1 on above, ultimate factored load will be	
	Factored moment Mf (kN-m)	11.13
	Factored shear Force Hf (KN)	2.92
	Factored Axial Vf(KN)	70.02
C	**Physical parameters of Poles**	
	Diameter of pole at ground level d	0.165
	Embedment length L (m)	1.70

	Project Name : 11kV Distribution for Raghughat Hydro Power Project	
	DESIGN OF POLE FOUNDATION	
		10.120
S.N	**Pole Type**	**30-60d**
D	**Soil Parameter**	
	Bulk Density of Soil g_b kN/cum	15
	Angle of Friction Fi	25
	Safe Bearing Capacity of soil	10
E	**Check against Vertical load**	
	Resisting Load from end bearing	12
	Resisting Bearing Load from skin friction	59
	Total resisting load	**70**
		ok
F	**Calculation of Diameter of foundation**	
	Equivalent eccentricity e = Mf/ Hf	3.819
	KP = {tan (45+Fi/2)}2	2.464
	Factor 2Hf / Kp r D	0.268
	Factor 2Mf /Kp r D	0.602
	Equation L^3 - 2Hf L / Kp r D * L - 2Mf /Kp g D = 0 Trial with value 'D' to get 0	0.022
	Required diameter of concrete pipe / plastic pipe	**0.178**
G	**Recommended dia of pole foundation**	
	Recommended dia of excavation /concrete /plastic pipe (m)	**1.230**

Project Name : 11kV Distribution for Raghughat Hydro Power Project

DESIGN OF POLE FOUNDATION

		D/C Pole
S.N	**Pole Type**	**60-90d**
A	For cohesionless soils, **Broms' procedure** may be used as per following equations, from which the required embedment length L can be found. Alternatively, if embedment length is given, Diameter D of foundation may be calculated.	
	Equation $L^3 - 2H_f L / K_p \gamma D * L - 2M_f / K_p \gamma D = 0$	
	in which $K_p = \{\tan(45+Fi/2)\}2$	
	Where D = shaft diameter / foundation diameter	
	Fi= Angle of repose	
	γ = Effectice density of soil	
	M_f = factored moment at ground line	
	H_f = Factored shear force at ground	
	Appiled load at pole at ground	
B	Load applied at pole at ground level (from PLS-pole calculations) maximum of each load case taken	
	Resultant moment at ground level M (kN-m)	37.77
	Shear force at ground level H (KN)	2.40
	Axial force V (N)	77.20
	Above loads are overloaded by a factor of 1.5 in PLS-Pole. Further, using a under capacity factor of 1.1 on above, ultimate factored load will be	
	Factored moment Mf (kN-m)	41.55
	Factored shear Force Hf (KN)	2.64
	Factored Axial Vf(KN)	84.92
C	**Physical parameters of Poles**	
	Diameter of pole at ground level d	0.165
	Embedment length L (m)	1.70

	Project Name : 11kV Distribution for Raghughat Hydro Power Project	
	DESIGN OF POLE FOUNDATION	
		D/C Pole
S.N	**Pole Type**	**60-90d**
D	**Soil Parameter**	
	Bulk Density of Soil g_b kN/cum	15
	Angle of Friction Fi	25
	Safe Bearing Capacity of soil	10
E	**Check against Vertical load**	
	Resisting Load from end bearing	17
	Resisting Bearing Load from skin friction	69
	Total resisting load	**86**
		ok
F	**Calculation of Diameter of foundation**	
	Equivalent eccentricity e = Mf/ Hf	15.738
	KP = {tan (45+Fi/2)}2	2.464
	Factor 2Hf / Kp r D	0.243
	Factor 2Mf /Kp r D	2.248
	Equation L^3 - 2Hf L / Kp r D * L - 2Mf /Kp g D = 0 Trial with value 'D' to get 0	0.028
	Required diameter of concrete pipe / plastic pipe	**0.510**
G	**Recommended dia of pole foundation**	
	Recommended dia of excavation /concrete /plastic pipe (m)	**1.450**

Project Name : 11kV Distribution for Raghughat Hydro Power Project

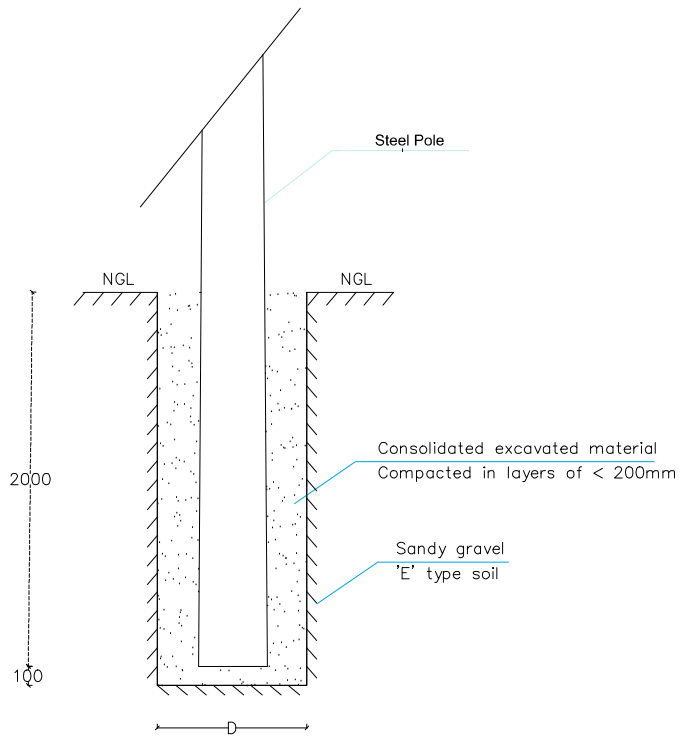
DESIGN OF POLE FOUNDATION

		D/C Pole
S.N	**Pole Type**	**Dead End**
A	For cohesionless soils, **Broms' procedure** may be used as per following equations, from which the required embedment length L can be found. Alternatively, if embedment length is given, Diameter D of foundation may be calculated.	
	Equation $L^3 - 2H_f L / K_p \gamma D * L - 2M_f / K_p \gamma D = 0$	
	in which $K_p = \{\tan(45+Fi/2)\}2$	
	Where D = shaft diameter / foundation diameter	
	Fi= Angle of repose	
	γ = Effectice density of soil	
	M_f = factored moment at ground line	
	H_f = Factored shear force at ground	
	Appiled load at pole at ground	
B	Load applied at pole at ground level (from PLS-pole calculations) maximum of each load case taken	
	Resultant moment at ground level M (kN-m)	66.33
	Shear force at ground level H (KN)	5.06
	Axial force V (N)	64.76
	Above loads are overloaded by a factor of 1.5 in PLS-Pole. Further, using a under capacity factor of 1.1 on above, ultimate factored load will be	
	Factored moment Mf (kN-m)	72.96
	Factored shear Force Hf (KN)	5.57
	Factored Axial Vf(KN)	71.24
C	**Physical parameters of Poles**	
	Diameter of pole at ground level d	0.165
	Embedment length L (m)	1.70

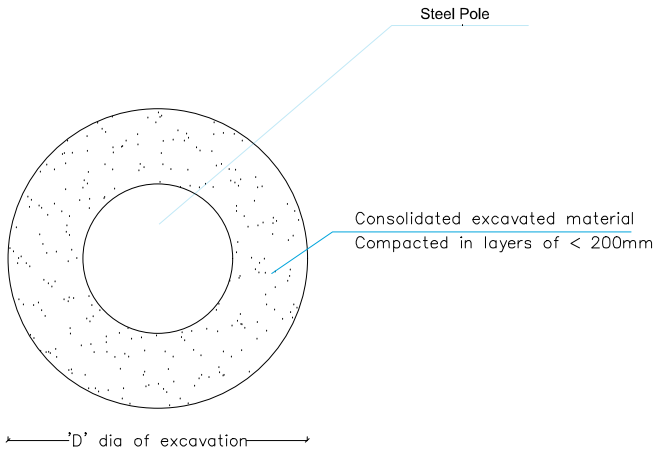
Project Name : 11kV Distribution for Raghughat Hydro Power Project

DESIGN OF POLE FOUNDATION

		D/C Pole
S.N	**Pole Type**	**Dead End**
D	**Soil Parameter**	
	Bulk Density of Soil g_b kN/cum	15
	Angle of Friction Fi	25
	Safe Bearing Capacity of soil	10
E	**Check against Vertical load**	
	Resisting Load from end bearing	12
	Resisting Bearing Load from skin friction	60
	Total resisting load	**72**
		ok
F	**Calculation of Diameter of foundation**	
	Equivalent eccentricity e = Mf/ Hf	13.109
	KP = {tan (45+Fi/2)}2	2.464
	Factor 2Hf / Kp r D	0.512
	Factor 2Mf /Kp r D	3.948
	Equation L^3 - 2Hf L / Kp r D * L - 2Mf /Kp g D = 0 Trial with value 'D' to get 0	0.011
	Required diameter of concrete pipe / plastic pipe	**0.910**
G	**Recommended dia of pole foundation**	
	Recommended dia of excavation /concrete /plastic pipe (m)	**1.250**



SIDE VIEW



PLAN VIEW

Pole Type	Description	Excavation Dia 'D'
D/SP	Intermediate Pole	1.210 m
D/SP/SS	Single pole single stay pin insu	0.830 m
D/SP/DS	Single pole double stay string	1.350 m
D/DP/FS	Double pole four stay string	1.230 m
D/DP/FS	Double pole four stay string	1.450 m
D/FP/FS	Four pole four stay string	1.250 m

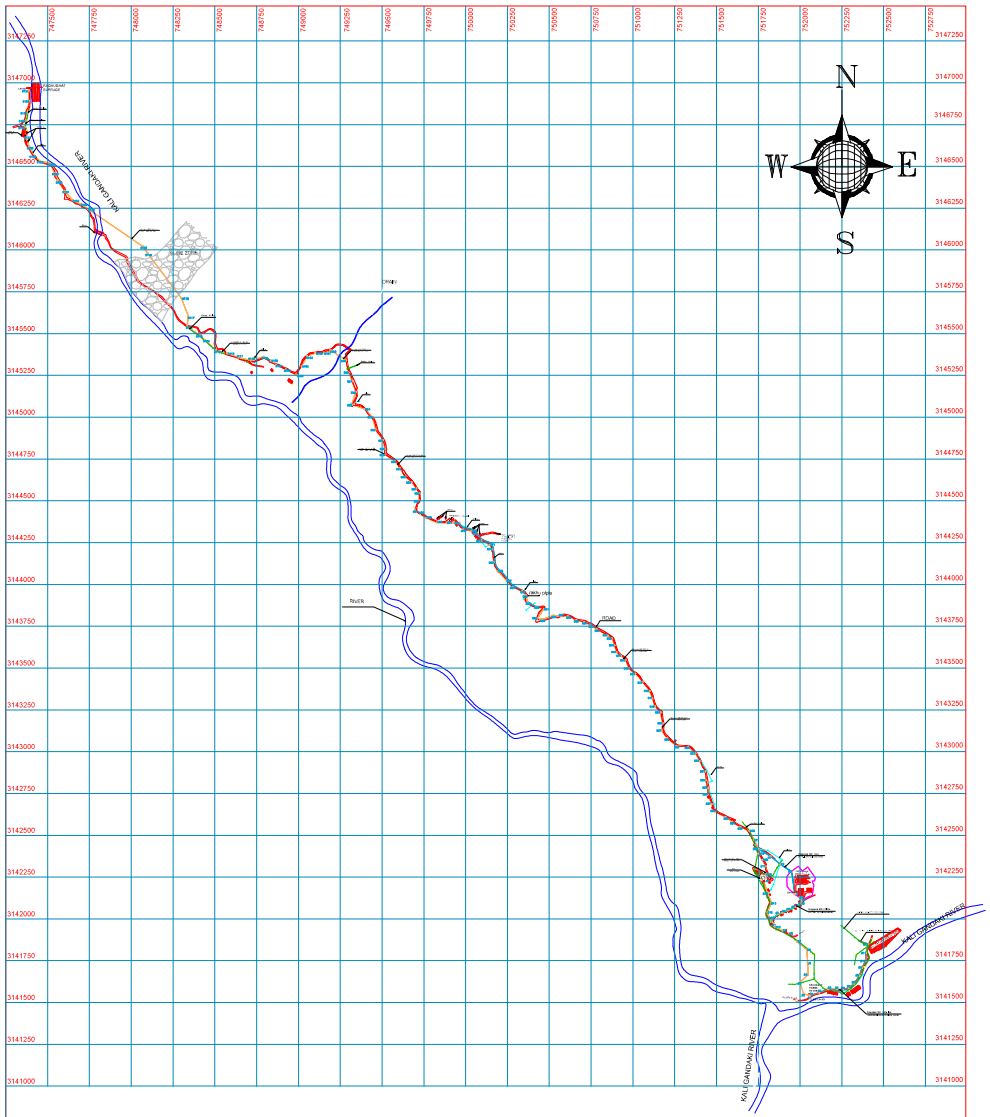
REV. No.	DATE	MECH.	CIVIL	ELEC.	RE	DESCRIPTION
		CHECKED				

CLIENT: RAGHUGANGA POWER LIMITED

CONTRACTOR: BHARAT HEAVY ELECTRICALS LTD.

CONSULTANT: THE DESIGNERS CONSORTIUM
A-435 LOGIX TECHNOVA SECTOR 132, NOIDA -04
Ph: 0120 4176259, 9958233117
e-mail : rks@tdcind.com
web : www.tdcind.co.in

CONTRACT NO :		PROJECT : RAGHUGHAT HYDRO ELECTRIC PROJECT(2X20MW)
PREPARED	NAME	DATE
DRAWN BY	SS	04.07.24
DESIGNED BY	AK	04.07.24
CHECKED BY	AKS	04.07.24
APPROVED BY		
SHEET SIZE	A1	DRAWING TITLE : FOUNDATION DRAWING OF DOUBLE CIRCUIT POLES
SCALE	1:10000	DRAWING NO : TDC/BHEL/RHP/FD/02 REV. 00 SHEET 01



LEGEND

ITEM DESCRIPTION		VALUE	SYMBOL
1	11kV D/C T/L (common for Dam & Colony)	1075.9m(D)	
2	11kV S/C T/L for Dam	7320.1m(S)	
3	11kV S/C T/L for Colony Alt-I	378.4m(C)	
4	LT T/L (440V) for colony AIT-2	246.1m(A)	
5	11kv S/C Additional T/L for Colony	534.5m(B)	
6	Double circuit Pole		
7	Single circuit Pole		
8	11kV LA+DS+FUSE Set	4 NOS	

1	TBM
2	Dam
3	River
4	Houses
5	Road
6	Cart track
7	River/Drain
8	Propose line
9	11kV line
10	LT line

Note:-

- All Dimensions are in meter.

CONTRACTOR: RAGHUGANGA POWER LIMITED

CLIENT: BHARAT HEAVY ELECTRICALS LTD.

CONSULTANT: THE DESIGNERS CONSORTIUM

PROJECT : RAGHUGHAT HYDRO ELECTRIC PROJECT

DRAWING TITLE : 11 kV DISTRIBUTION LINE - PRELIMINARY ROUTE SURVEY

DRAWING NO : TDC/BHEL/RHP/RA/01

SCALE 1:50000

Annexure 'A'

Project: 2x20MW Raghughat Hydro Power Projects

Angle Point Schedule of 11kV OHL from Power House to Dam and Colony Area

S. No.	Angle Point	Coordinate		Section Length (m)	Cummu Chainage (m)	Angle of Deviation	Crossing Details / Remarks	SC						DC					Average Span (m)
		Easting (m)	Northing (m)			d ⁰ m ' s "		0	0-10	0-30	30-60 /DE	SPL	60-90	0	0-10	0-30	30-60	DE / 60-90	
A: Proposed 11kV Double Circuit (Common for Dam/Barrage and Colony)																			
1	D1	752057.8	3141541				**Power House S/S**											1	
				39															39
2	D2	752020.3	3141551.9		39	# 0 42 ' 26 " R											1		
				72															72
3	D3	751999	3141621.2		112	# 0 3 ' 22 " R												1	
				65															65
4	D4	752048.3	3141664.1		177	# 0 44 ' 34 " L											1		
				75															75
5	D5	752044.7	3141738.9		252	0 0 ' 13 " L								1					
				75															75
6	D6	752041.1	3141813.6		327	# 0 35 ' 3 " L											1		
				78															78

Annexure 'A'

Project: 2x20MW Raghughat Hydro Power Projects

Angle Point Schedule of 11kV OHL from Power House to Dam and Colony Area

S. No.	Angle Point	Coordinate		Section Length (m)	Cummu Chainage (m)	Angle of Deviation	Crossing Details / Remarks	SC						DC					Average Span (m)
		Easting (m)	Northing (m)			d ⁰ m ' s "		0	0-10	0-30	30-60 /DE	SPL	60-90	0	0-10	0-30	30-60	DE / 60-90	
7	D7	751981.6	3141864.7		405	5 ⁰ 22 ' 26 " R										1			
				67			Road												67
8	D8	751935.2	3141912.8		472	# ⁰ 26 ' 24 " L										1			
				42			Road												42
9	D9	751896.5	3141929.7		514	0 ⁰ 40 ' 9 " R								1					
				49															49
10	D10	751851.9	3141949.8		563	9 ⁰ 37 ' 30 " R										1			
				33															33
11	D11	751824.8	3141968		596	# ⁰ 36 ' 57 " R											1		
				75			Road												75
12	D12	751804.7	3142040.4		671	# ⁰ 56 ' 56 " R											1		
				61															61
13	D13	751827.8	3142096.4		731	# ⁰ 53 ' 47 " L											1		

Annexure 'A'

Project: 2x20MW Raghughat Hydro Power Projects

Angle Point Schedule of 11kV OHL from Power House to Dam and Colony Area

S. No.	Angle Point	Coordinate		Section Length (m)	Cummu Chainage (m)	Angle of Deviation	Crossing Details / Remarks	SC						DC					Average Span (m)
		Easting (m)	Northing (m)			d ⁰ m ' s "		0	0-10	0-30	30-60 /DE	SPL	60-90	0	0-10	0-30	30-60	DE / 60-90	
				58															58
14	D14	751807.5	3142150.8		789	2 ⁰ 11 ' 25 " R										1			
				78															78
15	D15	751782.9	3142225.3		868	# ⁰ 49 ' 3 " R											1		
				46			Road												46
16	D16	751796	3142269.4		914	# ⁰ 14 ' 47 " L										1			
				47															47
17	D17	751793.8	3142316.3		961	# ⁰ 3 ' 29 " L										1			
				41															41
18	D18	751774	3142352.4		1002	2 ⁰ 59 ' 48 " L										1			
				45															45
19	D19	751750.2	3142390.9		1047	# ⁰ 32 ' 33 " R											1		
				29															29

Annexure 'A'

Project: 2x20MW Raghughat Hydro Power Projects

Angle Point Schedule of 11kV OHL from Power House to Dam and Colony Area

S. No.	Angle Point	Coordinate		Section Length (m)	Cummu Chainage (m)	Angle of Deviation	Crossing Details / Remarks	SC						DC					Average Span (m)
		Easting (m)	Northing (m)			d ⁰ m ' s "		0	0-10	0-30	30-60 /DE	SPL	60-90	0	0-10	0-30	30-60	DE / 60-90	
20	D20	751749.6	3142419.6		1076	# 0 31 ' 6 " L										1			
B: Proposed 11kV Single Circuit (Common point to Dam																			
21	S21	751724.1	3142475		1076	2 0 23 ' 53 " L				1									
				58															58
22	S22	751697.8	3142526.4		1134	# 0 25 ' 23 " L					1								
				60			Road												60
23	S23	751642.7	3142549.2		1193	# 0 41 ' 22 " R				1									
				58															58
24	S24	751594.2	3142580.9		1251	1 0 25 ' 0 " R				1									
				50															50
25	S25	751553.3	3142609.1		1301	6 0 52 ' 16 " L				1									
				67															67
26	S26	751494.1	3142640.2		1368	# 0 51 ' 11 " R					1								

Annexure 'A'

Project: 2x20MW Raghughat Hydro Power Projects

Angle Point Schedule of 11kV OHL from Power House to Dam and Colony Area

S. No.	Angle Point	Coordinate		Section Length (m)	Cummu Chainage (m)	Angle of Deviation	Crossing Details / Remarks	SC						DC					Average Span (m)
		Easting (m)	Northing (m)			d ⁰ m ' s "		0	0-10	0-30	30-60 /DE	SPL	60-90	0	0-10	0-30	30-60	DE / 60-90	
				53															53
27	S27	751469.6	3142687.4		1421	7 ⁰ 45 ' 51 " R				1									
				62															62
28	S28	751448.6	3142746.1		1483	# ⁰ 49 ' 20 " R				1									
				37															37
29	S29	751447.4	3142783		1520	# ⁰ 5 ' 5 " L				1									
				47															47
30	S30	751436.1	3142828.5		1567	# ⁰ 21 ' 27 " R				1									
				53															53
31	S31	751432.8	3142881.1		1620	# ⁰ 39 ' 47 " L				1									
				72															72
32	S32	751398.7	3142944.6		1692	0 ⁰ 47 ' 53 " R				1									
				52															52

Annexure 'A'

Project: 2x20MW Raghughat Hydro Power Projects

Angle Point Schedule of 11kV OHL from Power House to Dam and Colony Area

S. No.	Angle Point	Coordinate		Section Length (m)	Cummu Chainage (m)	Angle of Deviation	Crossing Details / Remarks	SC						DC					Average Span (m)
		Easting (m)	Northing (m)			d ⁰ m ' s "		0	0-10	0-30	30-60 /DE	SPL	60-90	0	0-10	0-30	30-60	DE / 60-90	
33	S33	751374.8	3142990.6		1744	# 0 33 ' 4 " L				1									
				58															58
34	S34	751330.1	3143028.1		1802	# 0 40 ' 59 " L					1								
				70															70
35	S35	751260.4	3143034.6		1872	# 0 9 ' 41 " R					1								
				75															75
36	S36	751202.6	3143082.2		1947	# 0 3 ' 59 " R				1									
				52															52
37	S37	751173.7	3143125.9		1999	# 0 1 ' 32 " R					1								
				43															43
38	S38	751178.6	3143168.7		2042	# 0 14 ' 44 " L				1									
				70															70
39	S39	751164.5	3143236.8		2112	# 0 51 ' 32 " L					1								

Annexure 'A'

Project: 2x20MW Raghughat Hydro Power Projects

Angle Point Schedule of 11kV OHL from Power House to Dam and Colony Area

S. No.	Angle Point	Coordinate		Section Length (m)	Cummu Chainage (m)	Angle of Deviation	Crossing Details / Remarks	SC						DC					Average Span (m)
		Easting (m)	Northing (m)			d ⁰ m ' s "		0	0-10	0-30	30-60 /DE	SPL	60-90	0	0-10	0-30	30-60	DE / 60-90	
				47															47
40	S40	751132	3143271		2159	# 0 15 ' 5 " R				1									
				52															52
41	S41	751116.5	3143320.8		2211	4 0 57 ' 0 " L				1									
				46															46
42	S42	751099	3143363.6		2258	# 0 11 ' 26 " L				1									
				68															68
43	S43	751057.9	3143417.3		2325	3 0 57 ' 9 " L				1									
				66															66
44	S44	751014.2	3143466.9		2391	9 0 7 ' 29 " L				1									
				49															49
45	S45	750976.1	3143498.3		2441	# 0 5 ' 34 " R				1									
				54															54

Annexure 'A'

Project: 2x20MW Raghughat Hydro Power Projects

Angle Point Schedule of 11kV OHL from Power House to Dam and Colony Area

S. No.	Angle Point	Coordinate		Section Length (m)	Cummu Chainage (m)	Angle of Deviation	Crossing Details / Remarks	SC						DC					Average Span (m)
		Easting (m)	Northing (m)			d ⁰ m ' s "		0	0-10	0-30	30-60 /DE	SPL	60-90	0	0-10	0-30	30-60	DE / 60-90	
46	S46	750956.2	3143549		2495	# 0 45 ' 1 " L				1									
				35															35
47	S47	750930.3	3143573		2530	4 0 29 ' 39 " L				1									
				37															37
48	S48	750901.6	3143595.7		2567	# 0 19 ' 19 " R					1								
				42															42
49	S49	750889.7	3143636.3		2609	4 0 24 ' 10 " L				1									
				44															44
50	S50	750874.1	3143677.5		2653	# 0 47 ' 39 " L					1								
				31															31
51	S51	750848.4	3143694.5		2684	3 0 41 ' 27 " L				1									
				74															74
52	S52	750784.3	3143731.2		2758	5 0 30 ' 18 " R				1									

Annexure 'A'

Project: 2x20MW Raghughat Hydro Power Projects

Angle Point Schedule of 11kV OHL from Power House to Dam and Colony Area

S. No.	Angle Point	Coordinate		Section Length (m)	Cummu Chainage (m)	Angle of Deviation	Crossing Details / Remarks	SC						DC					Average Span (m)
		Easting (m)	Northing (m)			d ⁰ m ' s "		0	0-10	0-30	30-60 /DE	SPL	60-90	0	0-10	0-30	30-60	DE / 60-90	
				44															44
53	S53	750748	3143756.9		2803	# 0 24 ' 51 " L				1									
				45															45
54	S54	750707.5	3143775.7		2847	# 0 24 ' 43 " L				1									
				47															47
55	S55	750661.7	3143786.7		2894	# 0 27 ' 49 " R				1									
				57															57
56	S56	750609.7	3143809.8		2951	# 0 48 ' 41 " L				1									
				41															41
57	S57	750568.9	3143809.2		2992	7 0 38 ' 42 " R				1									
				44			Road												44
58	S58	750525.2	3143814.4		3036	# 0 57 ' 7 " L				1									
				72															72

Annexure 'A'

Project: 2x20MW Raghughat Hydro Power Projects

Angle Point Schedule of 11kV OHL from Power House to Dam and Colony Area

S. No.	Angle Point	Coordinate		Section Length (m)	Cummu Chainage (m)	Angle of Deviation	Crossing Details / Remarks	SC						DC					Average Span (m)
		Easting (m)	Northing (m)			d ⁰ m ' s "		0	0-10	0-30	30-60 /DE	SPL	60-90	0	0-10	0-30	30-60	DE / 60-90	
59	S59	750457.3	3143790.8		3108	# 0 41 ' 10 " R					1								
				29															29
60	S60	750429.5	3143798		3137	# 0 53 ' 37 " L							1						
				68															68
61	S61	750467.1	3143854.5		3205	# 0 9 ' 5 " R							1						
				48			Road												48
62	S62	750421.3	3143869.2		3253	7 0 49 ' 2 " R				1									
				56															56
63	S63	750370.4	3143893.6		3309	# 0 13 ' 36 " R					1								
				42															42
64	S64	750360.8	3143934.6		3351	# 0 43 ' 30 " L				1									
				34			Road												34
65	S65	750338.2	3143959.8		3385	# 0 46 ' 35 " L				1									

Annexure 'A'

Project: 2x20MW Raghughat Hydro Power Projects

Angle Point Schedule of 11kV OHL from Power House to Dam and Colony Area

S. No.	Angle Point	Coordinate		Section Length (m)	Cummu Chainage (m)	Angle of Deviation	Crossing Details / Remarks	SC						DC					Average Span (m)
		Easting (m)	Northing (m)			d ° m ' s "		0	0-10	0-30	30-60 /DE	SPL	60-90	0	0-10	0-30	30-60	DE / 60-90	
				63															63
66	S66	750280.3	3143984.8		3448	# 0 15 ' 21 " R				1									
				53															53
67	S67	750244.7	3144023.8		3501	1 0 4 ' 31 " L				1									
				78															78
68	S68	750190.8	3144080.7		3579	# 0 42 ' 42 " R				1									
				57															57
69	S69	750167.1	3144132.1		3636	# 0 57 ' 59 " R				1									
				79															79
70	S70	750159.1	3144210.8		3715	# 0 41 ' 9 " L				1									
				31															31
71	S71	750144	3144237.5		3746	# 0 24 ' 39 " L					1								
				57															57

Annexure 'A'

Project: 2x20MW Raghughat Hydro Power Projects

Angle Point Schedule of 11kV OHL from Power House to Dam and Colony Area

S. No.	Angle Point	Coordinate		Section Length (m)	Cummu Chainage (m)	Angle of Deviation	Crossing Details / Remarks	SC						DC					Average Span (m)
		Easting (m)	Northing (m)			d ⁰ m ' s "		0	0-10	0-30	30-60 /DE	SPL	60-90	0	0-10	0-30	30-60	DE / 60-90	
72	S72	750092.8	3144262.6		3803	# 0 10 ' 57 " R					1								
				47			Road and houses												47
73	S73	750071.1	3144303.9		3849	# 0 24 ' 35 " L					1								
				39			Road and houses												39
74	S74	750035.2	3144319.8		3889	# 0 28 ' 48 " L				1									
				51															51
75	S75	749985.2	3144328.1		3939	# 0 43 ' 38 " R					1								
				47			Road												47
76	S76	749962.6	3144369.1		3986	# 0 40 ' 35 " L							1						
				77			Road												77
77	S77	749886.1	3144368.4		4063	2 0 48 ' 57 " R				1									
				58															58
78	S78	749828.2	3144370.7		4121	# 0 7 ' 30 " R				1									

Annexure 'A'

Project: 2x20MW Raghughat Hydro Power Projects

Angle Point Schedule of 11kV OHL from Power House to Dam and Colony Area

S. No.	Angle Point	Coordinate		Section Length (m)	Cummu Chainage (m)	Angle of Deviation	Crossing Details / Remarks	SC						DC					Average Span (m)
		Easting (m)	Northing (m)			d ⁰ m ' s "		0	0-10	0-30	30-60 /DE	SPL	60-90	0	0-10	0-30	30-60	DE / 60-90	
				69															69
79	S79	749764.6	3144398.2		4190	7 ⁰ 28 ' 60 " R				1									
				43															43
80	S80	749727.6	3144420.3		4233	1 ⁰ 51 ' 9 " R				1									
				42															42
81	S81	749692.4	3144442.9		4275	# ⁰ 18 ' 20 " R							1						
				67															67
82	S82	749718.6	3144504.6		4342	# ⁰ 44 ' 46 " L				1									
				42															42
83	S83	749721	3144546.5		4384	# ⁰ 51 ' 37 " L					1								
				32															32
84	S84	749704.7	3144574.1		4416	6 ⁰ 10 ' 37 " L				1									
				48															48

Annexure 'A'

Project: 2x20MW Raghughat Hydro Power Projects

Angle Point Schedule of 11kV OHL from Power House to Dam and Colony Area

S. No.	Angle Point	Coordinate		Section Length (m)	Cummu Chainage (m)	Angle of Deviation	Crossing Details / Remarks	SC						DC					Average Span (m)
		Easting (m)	Northing (m)			d ⁰ m ' s "		0	0-10	0-30	30-60 /DE	SPL	60-90	0	0-10	0-30	30-60	DE / 60-90	
85	S85	749676.2	3144612.3		4463	# ⁰ 21 ' 1 " L				1									
				50															50
86	S86	749638.2	3144644.1		4513	# ⁰ 43 ' 24 " R				1									
				63															63
87	S87	749604.5	3144697.3		4576	0 ⁰ 48 ' 47 " L				1									
				50															50
88	S88	749577.2	3144739.1		4626	# ⁰ 32 ' 17 " L				1									
				75															75
89	S89	749513.8	3144779.2		4701	# ⁰ 43 ' 33 " R							1						
				33															33
90	S90	749516.7	3144812.2		4734	# ⁰ 4 ' 59 " L				1									
				52															52
91	S91	749505	3144862.7		4786	# ⁰ 54 ' 32 " L				1									

Annexure 'A'

Project: 2x20MW Raghughat Hydro Power Projects

Angle Point Schedule of 11kV OHL from Power House to Dam and Colony Area

S. No.	Angle Point	Coordinate		Section Length (m)	Cummu Chainage (m)	Angle of Deviation	Crossing Details / Remarks	SC						DC					Average Span (m)
		Easting (m)	Northing (m)			d ⁰ m ' s "		0	0-10	0-30	30-60 /DE	SPL	60-90	0	0-10	0-30	30-60	DE / 60-90	
				77															77
92	S92	749461.8	3144926.9		4863	# 0 3 ' 35 " R				1									
				78			Road												78
93	S93	749441.8	3145002.1		4941	# 0 49 ' 6 " L					1								
				68			Road												68
94	S94	749392.9	3145049.8		5009	# 0 12 ' 51 " L				1									
				77															77
95	S95	749319.8	3145075.1		5087	# 0 28 ' 52 " R							1						
				80			11kv TL												80
96	S96	749342.6	3145151.8		5167	# 0 52 ' 37 " L					1								
				70															70
97	S97	749320.7	3145218		5237	4 0 37 ' 43 " L				1									
				53															53

Annexure 'A'

Project: 2x20MW Raghughat Hydro Power Projects

Angle Point Schedule of 11kV OHL from Power House to Dam and Colony Area

S. No.	Angle Point	Coordinate		Section Length (m)	Cummu Chainage (m)	Angle of Deviation	Crossing Details / Remarks	SC						DC					Average Span (m)
		Easting (m)	Northing (m)			d ⁰ m ' s "		0	0-10	0-30	30-60 /DE	SPL	60-90	0	0-10	0-30	30-60	DE / 60-90	
98	S98	749299.9	3145267.2		5290	# ⁰ 6 ' 15 " R				1									
				74			11kV TL												74
99	S99	749284.8	3145339.4		5364	# ⁰ 32 ' 32 " L					1								
				113				1											56
100	S100	749191.1	3145401.8		5476	# ⁰ 19 ' 49 " L					1								
				41			Road												41
101	S101	749153	3145385.9		5518	# ⁰ 27 ' 51 " R				1									
				52															52
102	S102	749101.2	3145383		5569	# ⁰ 59 ' 15 " L				1									
				52															52
103	S103	749052.8	3145365.2		5621	# ⁰ 42 ' 17 " L					1								
				67															67
104	S104	749019	3145306.9		5688	0 ⁰ 11 ' 19 " L				1									

Annexure 'A'

Project: 2x20MW Raghughat Hydro Power Projects

Angle Point Schedule of 11kV OHL from Power House to Dam and Colony Area

S. No.	Angle Point	Coordinate		Section Length (m)	Cummu Chainage (m)	Angle of Deviation	Crossing Details / Remarks	SC						DC					Average Span (m)
		Easting (m)	Northing (m)			d ⁰ m ' s "		0	0-10	0-30	30-60 /DE	SPL	60-90	0	0-10	0-30	30-60	DE / 60-90	
				63															63
105	S105	748987.7	3145252.5		5751	# 0 24 ' 12 " R							1						
				71															71
106	S106	748924.2	3145285.3		5823	2 0 35 ' 11 " L				1									
				64															64
107	S107	748865.8	3145312.2		5887	# 0 17 ' 13 " R				1									
				41			Road												41
108	S108	748835.5	3145339.5		5928	# 0 9 ' 46 " L				1									
				50															50
109	S109	748790.9	3145362.1		5978	# 0 48 ' 28 " L					1								
				78															78
110	S110	748716.3	3145340.8		6055	# 0 55 ' 33 " R				1									
				80															80

Annexure 'A'

Project: 2x20MW Raghughat Hydro Power Projects

Angle Point Schedule of 11kV OHL from Power House to Dam and Colony Area

S. No.	Angle Point	Coordinate		Section Length (m)	Cummu Chainage (m)	Angle of Deviation	Crossing Details / Remarks	SC						DC					Average Span (m)
		Easting (m)	Northing (m)			d ⁰ m ' s "		0	0-10	0-30	30-60 /DE	SPL	60-90	0	0-10	0-30	30-60	DE / 60-90	
111	S111	748638.5	3145357.3		6135	8 ⁰ 58 ' 18 " R				1									
				67															67
112	S112	748575.8	3145381.3		6202	4 ⁰ 29 ' 26 " L				1									
				74			Road												74
113	S113	748504.7	3145402.3		6276	# ⁰ 19 ' 29 " R				1									
				88															88
114	S114	748440.4	3145461.8		6364	0 ⁰ 5 ' 42 " L				1									
				41															41
115	S115	748410.6	3145489.3		6404	8 ⁰ 6 ' 30 " L				1									
				93															93
116	S116	748333.8	3145542.3		6498	# ⁰ 32 ' 36 " R							1						
				386			Road	5											64
117	S117	748341.5	3145603.8		6884	# ⁰ 46 ' 7 " L				1									

Annexure 'A'

Project: 2x20MW Raghughat Hydro Power Projects

Angle Point Schedule of 11kV OHL from Power House to Dam and Colony Area

S. No.	Angle Point	Coordinate		Section Length (m)	Cummu Chainage (m)	Angle of Deviation	Crossing Details / Remarks	SC						DC					Average Span (m)
		Easting (m)	Northing (m)			d ⁰ m ' s "		0	0-10	0-30	30-60 /DE	SPL	60-90	0	0-10	0-30	30-60	DE / 60-90	
				115				1											57
118	S118	748301.1	3145711.1		6998	# 0 16 ' 19 " L						1							
				337			Slide zone												337
119	S119	748098.8	3145980.5		7335	0 0 40 ' 6 " R						1							
				51															51
120	S120	748068.9	3146021.3		7386	# 0 22 ' 6 " L				1									
				394				5											66
121	S121	747743.9	3146243.8		7780	0 0 44 ' 7 " L				1									
				55															55
122	S122	747698.4	3146274.1		7834	6 0 54 ' 13 " L				1									
				53															53
123	S123	747650.8	3146298.1		7887	# 0 40 ' 36 " R				1									
				75			Road												75

Annexure 'A'

Project: 2x20MW Raghughat Hydro Power Projects

Angle Point Schedule of 11kV OHL from Power House to Dam and Colony Area

S. No.	Angle Point	Coordinate		Section Length (m)	Cummu Chainage (m)	Angle of Deviation	Crossing Details / Remarks	SC						DC					Average Span (m)
		Easting (m)	Northing (m)			d ⁰ m ' s "		0	0-10	0-30	30-60 /DE	SPL	60-90	0	0-10	0-30	30-60	DE / 60-90	
124	S124	747601.2	3146354		7962	6 ⁰ 24 ' 3 " R				1									
				69															69
125	S125	747561.3	3146410.6		8031	# ⁰ 51 ' 30 " R				1									
				55															55
126	S126	747540.4	3146461.5		8087	0 ⁰ 9 ' 11 " L				1									
				61			Road												61
127	S127	747516.9	3146518.3		8148	# ⁰ 27 ' 12 " L					1								
				65															65
128	S128	747453.3	3146531.9		8213	# ⁰ 14 ' 39 " R					1								
				48															48
129	S129	747417.8	3146564.2		8261	# ⁰ 41 ' 4 " R				1									
				62															62
130	S130	747388.8	3146618.7		8323	9 ⁰ 53 ' 36 " R				1									

Annexure 'A'

Project: 2x20MW Raghughat Hydro Power Projects

Angle Point Schedule of 11kV OHL from Power House to Dam and Colony Area

S. No.	Angle Point	Coordinate		Section Length (m)	Cummu Chainage (m)	Angle of Deviation	Crossing Details / Remarks	SC						DC					Average Span (m)
		Easting (m)	Northing (m)			d ⁰ m ' s "		0	0-10	0-30	30-60 /DE	SPL	60-90	0	0-10	0-30	30-60	DE / 60-90	
				62															62
131	S131	747369.6	3146677.3		8384	# 0 38 ' 8 " R				1									
				57			DG House												57
132	S132	747363.1	3146734.3		8442	# 0 1 ' 51 " R				1									
				40															40
133	S133	747371	3146773.1		8481	3 0 1 ' 17 " L				1									
				45															45
134	S134	747377.7	3146818		8527	0 0 8 ' 35 " R				1									
				75			Road												75
135	S135	747389	3146892.6		8602	9 0 50 ' 49 " L				1									
				61															61
136	S136	747387.7	3146953.8		8663	0 0 0 ' 0 " R							1						
C: Proposed 11kV Single Circuit (Common point to Colony) Alt-1																			

Annexure 'A'

Project: 2x20MW Raghughat Hydro Power Projects

Angle Point Schedule of 11kV OHL from Power House to Dam and Colony Area

S. No.	Angle Point	Coordinate		Section Length (m)	Cummu Chainage (m)	Angle of Deviation	Crossing Details / Remarks	SC						DC					Average Span (m)
		Easting (m)	Northing (m)			d ⁰ m ' s "		0	0-10	0-30	30-60 /DE	SPL	60-90	0	0-10	0-30	30-60	DE / 60-90	
137	D20	751749.6	3142419.6			⁰	**Common Point**												
				86															
138	C1	751822.8	3142374.9		86	7 ⁰ 37 ' 24 " R				1									
				79			transmission line												79
139	C2	751884.1	3142325.2		165	6 ⁰ 1 ' 20 " L				1									
				80															80
140	C3	751950.9	3142281.8		244	# ⁰ 37 ' 10 " R					1								
				134				1											67
141	C4	751968.1	3142148.8		378	0 ⁰ 0 ' 0 " R	**Colony S/S**						1						
							Sub Total	**13**		**84**	**24**	**2**	**10**	**2**		**8**	**8**	**2**	**59**
							Total Pole	**153**											

Bharat Heavy Electricals Limited

Powering Progress, Brightening Lives Touching Every Indian Home

REPORT ON ROUTE ALIGNMENT SURVEY

11kV DISTRIBULTION TRANSMISISON LINE FOR RAGHUGHAT HYDRPOWR PLANT

JULY, 2024

Survey Consultants

THE DESIGNERS' CONSORTIUM

CONTENTS

CHAPTER 1

INTRODUCTION

BHEL Ltd. is currently executing a contract for electro mechanical works for 2x20MW Raghughat Hydro Power Project in Nepal for Rahughanga Power Corporation Limited.

Two (2) Nos. 11kV Distribution Lines are proposed from Power House to Barrage site and Power House to Colony area for the requirement of power for operation of various auxiliaries, residential facilities and other misc. electrical loads at respective sites/areas. There are some common routes for some of route length to Barrage and to Colony. For this common route, double circuit poles are proposed to optimised the cost of pole and land acquisition cost.

Other than above, for the colony area, one more alternative also studied wherein a separate 11kV line from power house is taken up to KaliGandak resort and thereafter, this route joined a 11kV pole which is already feeding the colony area by a connection through electricity gris.

As these distribution lines traverse across the country terrains, the topographical & geographical nature of the terrains play significant influence in the project cost and implementation time. Hence it is essential that before construction work starts, various alternative routes and technical solutions for distribution lines be examined in detail.

For undertaking such studies, the major requirement is to obtain adequate information regarding physical constraints, environmental factors, etc; along the route so that optimum solutions are identified. Subsequently, during implementation of the project, it is required to obtain details about terrain, soil conditions, ground water level, etc. along the route for proper resource planning, costing, etc. as well as reduction in implementation time.

The report presents the alignment proposal for above said distribution lines, details as under:

- 11kV Distribution Line from Power House to Auxiliary Power House (Barrage)
- 11kV Distribution Line from Power House to Colony

CHAPTER 2

RESTRICTIONS IN THE CORRIDOR

The major hindrances that have been identified and taken into consideration before proposing the alternative route are:

- Proposed power project structures, habitats / villages/Village houses / hut which is coming within the corridor of the proposed alignment.
- Forest land which includes mainly Reserve Forest, Protected Forest and Social Forest land along with agricultural land.
- Density of forest land and private vegetation has been taken into consideration.
- The rivers and low-lying area that exists in the corridor along with other small streams.
- Existence of major roads which connect the different structures related to project.

CHAPTER 3

SELECTION OF ROUTE ALIGNMENT

To carry out the survey studies, a walk over survey along the above proposed routes have been carried out by our survey team.

Accordingly, keeping in view various aspect of route alignment constraints, routes of line have been explored based on the technical & environmental studies, keeping the construction and O&M cost to the minimum and also minimum harm to ecological flora and fauna of the area. In order to select the optimal viable route of the line, reconnaissance and walk over survey of the area was undertaken and routes are being proposed.

In recent times, remote sensing technology is being used in this field by means of satellite imageries and GPS equipment. Using GPS devices, it is possible to navigate any location on the ground with reasonable accuracy out to sub centimetre level. In view of the identification of best possible, most suitable and economically least expensive route for construction of distribution line, the route selection processes using satellite imaginaries and GPS equipment have been carried out, analysed and presented in this report in the form of compiled data and maps.

After the selection process of the best route is over, detailed survey using total station and/or DGSP has been carried out for picking up the data for creation of topographical feature and profile feature of the line corridor of the finalized route. The data, thus collected, shall be used to generate the ground profile en-route and finally pole spotting along with optimization using suitable software.

An effort has been made to keep the alternatives in proximity of the BEE line and approachable roads with minimizing the forest coverage and habitations. The routes were examined along the Bee line and nearer to existing road / track and all the routes are at a maximum distance of about 200m from the road / track.

Further, while choosing the best optimal route, following details are also taken in to consideration:

- Optimized Pole Spotting
- Best suitable for construction as well as future operation and maintenance purpose throughout the route length.
- The magnitude of the deviation angle is comparatively small.

The abstract of features of different distribution line routes based upon the route alignment survey & study of map are summarized and best route is proposed as under:

i) 11kV Distribution Line: Power House to Dam/Barrage

S. No.	Features	Route I
1	Route Length (m)	8663
2	No. of roads crossing	21
3	No. of river crossings	1
4	No. of power line crossing	3
5	Vicinity to approach roads	00m to 50m

The details of above feature are being enclosed at **'Annexure A'** along with GPS coordinates of angle point's en-route.

ii) T-off of 11kV T/L from Proposed 11kV to Colony (Alt-1)

S. No.	Features	Route I
1	Route Length (m)	378
2	No. of roads crossing	0
3	No. of river crossings	0
4	No. of power line crossing	1
5	Vicinity to approach roads	00m to 50m

The details of above feature are being enclosed at **'Annexure A'** along with GPS coordinates of angle point's en-route.

iii) T-off of LT Line (440V) to Colony area by providing T/F on Proposed 11kV T/L on Existing LT poles (Alt-2)

S. No.	Features	Route I
1	Route Length (m)	648
2	No. of roads crossing	2
3	No. of river crossings	0
4	No. of power line crossing	0
5	Vicinity to approach roads	00m to 10m

The details of above feature are being enclosed at **'Annexure B'** along with GPS coordinates of angle point's en-route.

iv) Additional Route of 11kV T/L from Power House to existing 11kV Line to Colony

BHARAT HEAVY ELECTRICALS LIMITED
TRANSMISSION BUSINESS HVDC & SYSTEMS

DOCUMENT No.	TB-409-316-000	Rev. No.	00		Prepared	Checked	Approved
TYPE OF DOC.	TECHNICAL SPECIFICATION			SIGN			
TITLE	GENERAL TECHNICAL REQUIREMENTS-SECTION 3			NAME	NS	NK	SKS
				DATE	05.07.23	05.07.23	05.07.23
				GROUP	TBEM	W.O. No	

CUSTOMER/ ENGINEER	Raghuganga Hydropower Limited, NEPAL/WAPCOS LTD.
PROJECT	**220 kV AIS S/S AT RAHUGHAT HYDRO ELECTRIC PROJECT (2X20MW)**
NOA NO.	**WAP/HYDRO/BHEL-RAGHUGHAT/NP/2019/266 DATED 04.12.19**
Station	**RAHUGHAT, NEPAL**

S.No.	Description	Sheet
1	General Technical Requirements – Site Information	1
2	General Technical Requirements	2-29
3	Annexure -1	7 Sheets

Rev No.	Date	Altered	Checked	Approved	REVISION DETAILS

Distribution	To	HVDC	TBMM	TBQM	Supplier
	Copies	1	1	1	4

GENERAL TECHNICAL REQUIREMENTS-SECTION 3
Site Information

S.No.	Particular	Details
a)	Customer	Raghuganga Hydropower Limited, Nepal
b)	Engineer	WAPCOS Ltd.
c)	Project Title	220 kV AIS S/S AT RAHUGHAT HYDRO ELECTRIC PROJECT (2X20MW)
d)	Location	Rahughat Hydroelectric Project (RGHEP) is located between the Latitudes 28°22'21" to 28°25'45"N and the Longitudes 83°31'13" to 83°34'35"E in Myagdi District, Western Development Region, Nepal
e)	Transport Facilities	The project is 1060 Km from nearest Indian Port Kolkata and 360 Km from Raxaul (India)/ Birgunj (Nepal) via Narayanghat, Pokhara and Beni. The nearest railhead (broad-gauge) is Raxaul and nearest International Airport is Kathmandu which is about 300Km from the project site. The nearest airport to the project site is Pokhara. Access from Kolkata to the site is available by road or by combination of railway and road. The shortest access from the border to the site will be from Bhairahawa. The last rail connected point in India for this border point is Nautanawa. The road from Nautanwa to Pokhara, via Bhairahawa and Butwal is nearly 214 km long. Another possible access from India would be via Raxaul where there is a railway station with broad gauge line. The road from Raxaul to Pokhara passes via Birgunj, Hetauda and Narayanghat - Mugling, which is about 272 km long. The main access to the project site will be along the Pokhara – Baglung and Baglung –Jomsom highway. The Baglung – Jomsom highway passes or runs through Beni and Galeshwor.
SITE CONDITIONS		
a)	Max. ambient air temp.	40°C
b)	Min. ambient air temp.	0°C
c)	Max. design ambient temp.	40°C
d)	Design reference temp.	40°C
e)	Relative Humidity	Max. 70% - The equipment shall operate satisfactorily without deterioration in 90% humidity
f)	Special corrosion conditions	No
g)	Altitude above sea level	Less than 1000 meter above mean sea level (MSL)
h)	Seismic Zone	The design horizontal seismic coefficient for the project area is 0.2 for the design of all structures except Circuit Breaker.
WIND DATA		
	Wind velocity	47m/sec
Main Electrical Parameters:		
	Fault Levels:	245kV: 40kA for 1 sec
	Creepage Distance	25mm/kV for All Equipment

GENERAL TECHNICAL REQUIREMENTS-SECTION 3

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GENERAL TECHNICAL REQUIREMENTS-SECTION 3

1.0 FOREWORD

The provisions under this section are intended to supplement requirements for the materials, equipments and services covered under other sections of tender documents and are not exclusive.

The purpose of this section of the specification is to apprise the Bidder with the general requirements applicable as per requirements in section 1 and section 2 of technical specification.

The present directions are to be read in conjunction with the Particular Technical Specifications/General Technical Specifications/General Specifications/Technical Data Sheets/Tender Drawings and the Conditions of the Contract.

The Supplier shall note that the standards mentioned herein are not mutually exclusive or complete in themselves, but are intended to complement each other, with minimum repetition, to define the requirements of the Specification. In the event of a conflict between requirements of any two clauses of the Specification/ documents or requirements of different codes/ standards specified, the more stringent requirement as per the interpretation of the owner/engineer shall apply, unless confirmed otherwise by the owner/engineer in writing based on a written request from the Supplier.

In case of conflicting requirements between this document (General Technical Requirement Section 3) and equipment specification (Section 1 & Section 2), equipment specification shall prevail.

When specific requirements stipulated in the Specification exceed or change those required by the applicable standards, the stipulations of the Specification shall take precedence.

Unless specifically agreed to by the Purchaser prior to Award of Contract, the Work shall be in accordance with the standards indicated and the requirements of the Specification. The Supplier shall be held responsible for any deviation.

In case of conflict between the various standards, the decision of owner/engineer shall be binding & final.

2.0 GENERAL REQUIREMENT

The following words and expressions shall have the meanings hereby assigned to them throughout this document

"Employer/Owner" means Raghuganga Hydropower Limited, Nepal

“**Engineer**” means WAPCOS Limited, India

“Purchaser” means Bharat Heavy Electricals Limited

"Supplier/Manufacturer/Bidder" means the person or persons, firm or company assigned to execute the works as defined by the scope of supply, described here.

"Specification" refers to this document.

Any cost involved in vendor assessment/approval must be borne by the vendor himself.

2.1 The Supplier/Manufacturer shall furnish catalogues, engineering data, technical information, design documents, drawings etc., fully in conformity with the technical specification during detailed engineering.

2.2 It is recognised that the Bidder may have standardised on the use of certain components, materials, processes or procedures different from those specified herein. Alternate proposals offering similar equipment based on the manufacturer's standard practice will also be considered provided such proposals meet the specified designs, standard and performance requirements and are acceptable to Employer/Engineer.

2.3 Wherever a material or article is specified or defined by the name of a particular brand, Manufacturer or Vendor, the specific name mentioned shall be understood as establishing type, function and quality and not as limiting competition.

2.4 Equipment furnished shall be complete in every respect with all mountings, fittings, fixtures and standard accessories normally provided with such equipment and/or needed for erection, completion and safe operation of the equipment as required by applicable codes though they may not have been specifically detailed in the Technical Specifications unless included in the list of exclusions. Materials and components which are minor in nature and incidental to the requirement but not specifically stated in the specification, which are necessary for commissioning and satisfactory operation of the switchyard/ substation unless specifically excluded shall be deemed to be included in the scope of the specification and shall be supplied without any extra cost. All similar standard components/parts of similar standard equipment provided, shall be inter-changeable with one another.

2.5 The purpose of this section of the specification is to apprise the Bidder with the general technical requirements applicable to the works called for in enquiry which are covered under Lot 2-Electro Mechanical Works for the project.

2.6 The present directions are to be read in conjunction with Section 1 & Section 2 of the technical specification.

3.0 STANDARDS AND CODES

3.1 General

The Works shall comply with the relevant standards/codes/practices adopted in Nepal. Provided there is no conflict with these documents/practices, and unless otherwise stated, all parts of the Works shall comply with the relevant international standards and design codes. Unless otherwise specified, the standards and recommendations under which the equipment is to be designed, manufactured, transported or delivered, installed or constructed, tested and commissioned shall be the following:

EN/DIN = Euronorrn/Deutsches Institut fill- Normung
IEC = International Electro-technical Commission
ISO = International Standards Organization
VDI = Verein Deutscher Ingeniure
VDE = Verein Deutscher Elektrotechniker
NEMA = National Electrical Manufacturers Association
FEM = Federation Europeene de Manutention
USAS = United States of America Standards Institute
BSS = British Standard Specifications
IS = Indian Standard
JIS = Japanese Industrial Standard

It shall be understood that the latest revision or edition, including possible amendments in effect at the time of receipt of tenders shall apply.

No deviation from the standards shall be made subsequent to execution of the Contract without the written approval of the Engineer.

The Bidder shall clearly state in his bid documents as to which standards will be applicable in each and every case where alternatives have been left open in the specification. In case of no indication the most stringent standard requirements shall apply.

3.2 Standards and Codes Named in the Specification

Although the Works shall generally comply with international standards, any instruction in these Specifications that a particular aspect of the Works shall comply with a named code or standard shall take precedence and that particular aspect of the Works shall comply with the named code or standard.

3.3 Hierarchy of Standards

In the event of any conflict in standards, the hierarchy of standards shall be as follows, with the standards occurring first in the list taking precedence over any standards later in the list:

(i) Statutory regulations of Nepal
(ii) Standards named in the Technical Specifications
(iii) International Standards
(iv) Other Standards approved by the Employer/Engineer.

Where equipment is specified to a particular standard, the Bidder may supply equipment of an equivalent standard, if approved by the Engineer.

Immediately after the Contract Agreement is executed the Bidder shall supply an indexed list of all standards, codes and associated standards referred to, to which the Works will be performed. The standards in the English language shall be made available to the Employer/Engineer.

Bidder shall provide to site during the period of the site works the applicable Standards and Codes of Practice concerning the site works in general, and the field tests of materials and equipment in

particular. Two sets of these documents shall be provided by the Bidder to the Employer/Engineer.

3.4 Substitution of Standards and Design Codes

The Bidder may offer Works which comply with international standards, or internationally recognised national codes or standards, which differ from those specified. The Bidder, however, may offer Works which comply with the different standards or codes only if, when requested by the Engineer, he is able to demonstrate to the Engineer's satisfaction that the Works offered are equal or superior to that which would have resulted had the specified code or standard been used. This substitution of codes or standards than those specified will only be acceptable if the manufacturing organisation in question has extensive experience with the alternative code or standard offered.

Bidder offering Works or part of those Works to standards and codes, which differ from those specified shall declare the fact to the Engineer and the Bidder shall also supply to the Employer and Engineer, at his own cost, two copies in English of these relevant code or standard, which he proposes to substitute for that specified.

4.0 SERVICES TO BE PERFORMED BY THE EQUIPMENT BEING FURNISHED

4.1 The equipment furnished under this specification shall perform all its functions and operate satisfactorily without showing undue strain, restrike etc under over voltage conditions.

4.2 All equipments shall also perform satisfactorily under various other electrical, electromechanical and meteorological conditions of the site of installation.

4.3 All equipment shall be able to withstand all external and internal mechanical, thermal and electromechanical forces due to various factors like wind load, temperature variation, ice & snow, (wherever applicable) short circuit etc for the equipment.

4.4 The bidder shall design terminal connectors of the equipment taking into account various forces that are required to withstand.

4.5 The equipment shall also comply to the following:

a) To facilitate erection of equipment, all items to be assembled at site shall be “match marked”.

b) All piping, if any between equipment control cabinet/operating mechanism to marshalling box of the equipment, shall bear proper identification to facilitate the connection at site.

4.6 System Parameter

220kV System

SL No	Description of parameters	220kV System
1.	System operating voltage	220kV

2.	Maximum operating voltage of the system (rms)	245kV
3.	Rated frequency	50HZ
4.	No. of phase	3
5.	Rated Insulation levels	
i)	Full wave impulse withstand voltage (1.2/50 microsec.)	1050kVp
ii)	Switching impulse withstand voltage (250/2500 micro sec.) dry and wet	-
iii)	One minute power frequency dry withstand voltage (rms)	-
iv)	One minute power frequency dry and wet withstand voltage (rms)	460kV
6.	Corona extinction voltage	-
7.	Max. radio interference voltage for frequency between 0.5 MHz and 2 MHz	1000 µV at 156 kV rms
8.	Minimum creepage distance - for Equipment other than Insulator string	6125mm
	Minimum creepage distance - for Insulator String	As per requirement
9	Min. clearances	
i.	Phase to phase	**2100mm**
ii.	Phase to earth	**2100mm**
iii.	Sectional clearances	5000 mm
10.	Rated short circuit current for 1 sec. duration	40kA
11.	System neutral earthing	Effectively earthed

Notes:

1. The above parameters are applicable for installations up to an altitude of 1000m above mean sea level. For altitude exceeding 1000m, necessary altitude correction factor shall be applicable as per relevant IEC.

2. The insulation and RIV levels of the equipments shall be as per values given in the Technical Specification of respective equipment.

5.0 ENGINEERING DATA AND DRAWINGS

5.1 The Bidder shall supply the storage as well as Erection and Commissioning manuals for various equipment/systems under their scope of supply. The storage manuals should be received at site at least 15 days before arrival of each and every major equipment/system at site. The Operation and Maintenance Manuals shall be supplied well in advance before the Taking-Over Certificate is issued by the Engineer.

5.2 Drawings

5.2.1 Before manufacturing of the equipment and start of site construction works, the dimensioned drawings and diagrams, showing all details of the equipment and materials to be used as well as all arrangements related to the other works shall be submitted to the Engineer for approval and to the Employer simultaneously. In any case, these drawings shall be submitted well in advance to permit modifications to be made, if deemed to be necessary and /or as instructed by the Engineer without delaying the commencement of the works.
The drawings which are requested to be modified as necessary by the Engineer shall be resubmitted for approval. Submission of Design Calculations shall be accompanied with the copies of standards and references adopted. Claims of extension of time will not be permitted on account of the late submission of drawings to the Engineer or for delays caused by drawings being returned not approved and for re-submission by the Engineer. Drawings submitted for reference shall be submitted in the same manner as for the approved drawings. Should any modification is required the Engineer may instruct the Bidder to do so and the drawings so modified shall be resubmitted for approval.

It shall be understood however that approval of the drawing by the Engineer will not exonerate the Bidder from any of his liabilities under the Contract.

All drawings submitted for approval or sent to the Employer and/or the Engineer for any other reason shall be sent by registered mail with quickest possible mean. An electronic copy of the drawings shall also be delivered by e-mail.

A period of at least three weeks should be allowed for such approval and another one week for return mail.

After all items of the work have been manufactured and erected, electronic copy of drawings and calculation sheets as well as As-built Drawings (hard and soft copy) shall be submitted to the Employer and the Engineer.

As-built Drawings should be prepared and submitted promptly and as soon as one items of work involving some sub-system or system is erected and tested. Submission of such drawings should not wait till the complete plant is tested and commissioned.

5.3 Inspection and Test procedure

The Bidder shall submit to the Employer/Engineer for approval, during or immediately following the submission of drawings, inspection and test procedure to be performed during manufacture, erection and tests on completion. The Bidder shall also be required to submit photocopy of relevant codes of standards for testing.

Procedure shall define sequence of inspection and test, equipment preparation, operation procedures to be followed and, detailed procedure for conducting the inspection and tests, and moreover shall contain design values, technical particulars or any other standard data for testing which will be treated as the criteria for evaluation of each inspection or test. Procedure shall be separately prepared for the inspection and tests to be performed at the shop and at the Site, and submitted for approval.

5.4 Instruction Manuals

The Bidder shall submit to the Employer/Engineer for approval the instruction manuals concerning the correct manner of erection for the work as early as possible but well before despatch of the Equipment and those for the operation and maintenance not later than six months before Taking over of the Works, with special references to any recently developed features. Instruction manuals shall describe in detail erection procedure and use of all erection equipment and measurement devices. Procedure for assembling, adjusting, operating and dismantling of each component system and machine shall be described and illustrated.

Maintenance of each component shall be described in detail including the recommended frequency of inspections and lubrication. The instruction manuals shall include easily readable diagrammatic drawings of the equipment to facilitate understanding the descriptive information. The Bidder shall, in preparing the instruction manuals, take into account the lack of experience and familiarity of the operating personnel with this type of equipment. The instruction manuals shall include a complete list of all drawings prepared for this Contract, spare parts list, and a parts list for each component of item of equipment. The parts list shall include manufacturer's code and serial numbers and ordering instructions and shall be detailed as far as possible for only the equipment supplied.

5.5 Submission of Technical Documents

5.5.1 Numbers to be submitted

All technical documents to be submitted by the Bidder under the Contract, shall be submitted in the following number of copies:

Document		Distribution	
		Engineer	Employer
1	***General Technical Documents:***		
1.1	- Draft version for Approval	3 H + 1 E	3 H + 1 E
1.2	- Final version after Approval including correction	3 H + 1 E	3 H + 1 E
2	***As-built Drawings:***		
2.1	- Draft version for Approval	3 H + 1 E	3 H + 1 E
2.2	- Final version after Approval including corrections	2 H + 2 E	4 H + 2 E
3	***Operation and Maintenance Manuals:***		

	Document	Distribution	
		Engineer	Employer
3.1	- Preliminary version 112 days prior to commencement of Commissioning	3 H + 2 E	3 H + 1 E
3.2	- Final Draft version for Approval	3 H + 1 E	3 H + 1 E
3.3	- Final version after Approval including corrections	2 H + 2 E	4 H + 2 E
4	*Commissioning Manuals:*		
4.1	-Tentative version for Approval	3 H + 2 E	3 H + 1 E
4.2	- Final version after Approval including corrections	2 H + 2 E	4 H + 2 E

Key: H = hardcopy (paper or other as appropriate);
E= electronic copy, with fully open accessibility, editing and user capability, stored on CD or DVD or other approved electronic medium.

5.6 As-Built Drawings

The Bidder shall submit as-built drawings of the completed works to the Engineer/Employer immediately after commissioning but well before the expiration of Defect Liability Period. The numbers of copies shall be as described in Sub-Clause 5.5. The as-built drawings shall clearly show the details and dimensions of the permanent equipment/systems for which construction/manufacturing has been actually made, based on the changes of design from time to time as ordered by the Engineer or proposed by the Bidder and approved by the Employer/Engineer.

NOTE :

(1) The bidder may please note that all resubmissions must incorporate all comments given in the earlier submission by the Employer/Engineer or adequate justification for not incorporating the same must be submitted failing which the submission of documents is likely to be returned.

(2) All drawings should be submitted in softcopy/hardcopy form, however substation design drawings like SLD, GA, all layouts etc. shall also be submitted in AutoCAD Version. SLD, GA & layout drawings shall be submitted for the entire substation in case of substation extension also.

(3) If after the commissioning and initial operation of the substation, the instruction manuals require any modifications/additions/changes, the same shall be incorporated and the updated final instruction manuals shall be submitted by the Bidder to the Employer.

(4) The Bidder shall furnish to the Employer/Engineer catalogues of spare parts.

(5) All As-built drawings/documents shall be certified by site indicating the changes before final submission.

6.0 MATERIAL/ WORKMANSHIP

6.1 General Requirement

6.1.1 Where the specification does not contain references to workmanship, equipment, materials and components of the covered equipment, it is essential that the same must be new, of highest grade of the best quality of their kind, conforming to best engineering practice and suitable for the purpose for which they are intended.

All materials incorporated in the equipment supplied shall be new and of first-class commercial quality, free from defects and imperfections, and shall be of the classifications and grades designated.

Materials for various components including the standard are presented in Annexure 1.

All material, components, supplies and articles not manufactured by the Bidder shall be products of recognized and/or reputed manufacturers.

Samples of the materials contemplated for incorporation in the Works, together with performance capacity data and other significant information pertaining to the material shall be furnished to the Employer/Engineer for approval. Materials installed or used without such approval shall be at the risk of subsequent rejection.

Material tests shall be conducted at the manufacturer's premises or at other places agreeable to the Employer/Engineer, in accordance with the requirements of the DIN standards or other appropriate and agreed standards. The results of these tests shall be in such a form as to provide a means of determining compliance with the applicable specifications for the material tested.

Where the Bidder desires to use stock material not manufactured specifically for the Works, satisfactory evidence that such material conforms to the requirements stated in the Contract shall be furnished to the Employer/Engineer, in which case tests on these materials may be waived. In such a case it will be essential that the purchase, testing, marking and stocking of such material had been supervised by an established quality control system. Relevant documents in this regard would need to be submitted. The cost of performing all of the material tests and the supply of samples shall be fully borne by the Bidder.

6.1.2 In case where the equipment, materials or components are indicated in the specification as "similar" to any special standard, the Employer/Engineer shall decide upon the question of similarity. When required by the specification or when required by the Employer/Engineer the Bidder shall submit, for approval, all the information concerning the materials or components to be used in manufacture. Machinery, equipment, materials and components supplied, installed or used without such approval shall run the risk of subsequent rejection, it is to be understood that the cost as well as the time delay associated with the rejection shall be borne by the Bidder.

6.1.3 The design of the Works shall be such that installation, future expansions, replacements and general maintenance may be undertaken with a minimum of time and expenses. Each component shall be designed to be consistent with its duty and suitable factors of safety, subject to mutual agreements. All joints and fastenings shall be devised, constructed and documented so that the

component parts shall be accurately positioned and restrained to fulfil their required function. In general, screw threads shall be standard metric threads. The use of other thread forms will only be permitted when prior approval has been obtained from the Employer.

6.1.4 Whenever possible, all similar part of the Works shall be made to gauge and shall also be made interchangeable with similar parts. All spare parts shall also be interchangeable and shall be made of the same materials and workmanship as the corresponding parts of the Equipment supplied under the Specification. Where feasible, common component units shall be employed in different pieces of equipment in order to minimize spare parts stocking requirements. All equipment of the same type and rating shall be physically and electrically interchangeable.

6.1.5 All works shall be performed and completed in a thorough manner following the best modern practices in the manufacture of high-grade equipment. All works shall be performed by craftsmen skilled in their various trades.

Machining of renewable parts shall be accurate and to specific dimensions, so that replacements made as per drawing may readily be installed. Like parts and spare parts shall be interchangeable.

Drilled holes for bolts shall be accurately located and drilled to templates.

All work shall be performed so as to secure proper matching of adjoining unfinished surfaces. Where there is a large discrepancy between adjoining surfaces, these shall be chipped and ground smooth or machined to ensure proper alignment. Unfinished surfaces shall be true to these lines and dimensions shown on the drawings, and shall be ground so as to be free from projections and rough spots. Depressions and cavities not affecting the strength or usefulness of the parts may be filled in a manner approved by the Employer/Engineer.

The surface finish of all parts and components shall be in conformity with the respective strength, fit and service requirements. Surfaces to be machine finished shall be indicated on the shop drawings by corresponding symbols.

All electronic equipment shall be manufactured under the supervision of an established quality control system.

All materials and components used must have undergone thorough type testing and detailed verification tests in the Bidder's/manufacturer's laboratories on random samples to prove compliance with specified data which must be sufficiently stringent to guarantee trouble free service. For any material or component used, at least two approved suppliers must exist, whose products have been type tested. Under no circumstances materials or components shall be bought from suppliers not approved by the Engineer, except stock material for which requisite data/kept reports etc. as designed by the Engineer shall require to be submitted for approval.

All materials and components must pass requisite testing after receipt of materials. Such testing shall be made on each individual piece for active components.

For materials and passive components random sample testing according to an internationally accepted principle/practice shall be performed. Such testing shall be carried out by automatic testing circuits to a high degree.

A clear marking system must exist within the manufacturer's Quality Control System to identify good and faulty components and materials.

During manufacture of printed circuit boards or other sub-assemblies best use shall be made of automatic testing circuits at various stages of manufacture. Sufficient number of manufacturer's inspectors shall be present.

During final testing besides verification of pertinent data and characteristics, tolerances must be verified so that inter-changeability will be always assured between identical parts.

All-important sub-assemblies or complete apparatus shall be subject to a 100 hours burn-in phase (temperature plus voltage stress). Essential characteristics and tolerances shall be checked before and after this phase.

Detailed data sheets or type testing certificates must be made available of all sub-assemblies or complete apparatus.

6.1.6 Compatible makes and grades of oil shall be provided for applicable equipment under scope of supply.

Points requiring grease lubrication shall be provided with a sufficient number and easily accessible greasing nipples or boxes.

Lubrication oils and greases used throughout the works shall be of a make and grade readily and commercially available in Nepal.

The first filling of lubricating and insulation oil and grease (including flushing oil for all equipment supplied) plus an excess of ten (10) percent of the overall net quantity required shall be included in the supply. Extra oil, wherever asked as spare, shall also be supplied. The Bidder shall inform the Employer about the quantities of oil, grease and other lubricants to be kept in stock for three (3) years operation.

6.2 Provisions For Exposure to Hot and Humid climate

Outdoor equipment supplied under the specification shall be suitable for service and storage under tropical conditions of high temperature, high humidity, heavy rainfall and environment favourable to the growth of fungi and mildew. The indoor equipments located in non-air conditioned areas shall also be of same type.

6.2.1 Space Heaters

6.2.1.1 The heaters shall be suitable for continuous operation at 230V as supply voltage. On-off switch and fuse shall be provided.

6.2.1.2 One or more adequately rated thermostatically connected heaters shall be supplied to prevent condensation in any compartment. The heaters shall be installed in the compartment and electrical connections shall be made sufficiently away from below the heaters to minimize deterioration of supply wire insulation. The heaters shall be suitable to maintain the compartment temperature to prevent condensation.

6.2.2 FUNGI STATIC VARNISH

Besides the space heaters, special moisture and fungus resistant varnish shall be applied on parts which may be subjected or predisposed to the formation of fungi due to the presence or deposit of nutrient substances. The varnish shall not be applied to any surface of part where the treatment will interfere with the operation or performance of the equipment. Such surfaces or parts shall be protected against the application of the varnish.

6.2.3 Ventilation opening

Wherever ventilation is provided, the compartments shall have ventilation openings with fine wire mesh of brass to prevent the entry of insects and to reduce to a minimum the entry of dirt and dust.

6.2.4 Degree of Protection

The enclosures of the Control Cabinets, Junction boxes and Marshalling Boxes, panels etc. to be installed shall comply with following degree of protection as detailed here under:
a) Installed out door: IP- 55
b) Installed indoor in air conditioned area: IP-31
c) Installed in covered area: IP-52
d) Installed indoor in non-air conditioned area where possibility of entry of water is limited: IP-41.
e) For LT Switchgear (AC & DC distribution Boards): IP-52

The degree of protection shall be in accordance with IEC-60947 (Part-I)/ IEC-60529/Other International Standards. Type test report for IP-55 or higher degree of protection test, shall be submitted for approval.

6.3 NAMEPLATES, LABELS, VISUAL DISPLAY UNITS

6.3.1 All equipment and each major and auxiliary item of equipment shall have a permanently affixed nameplate, showing in a legible and durable manner the name and place of the manufacturer, model and serial number, year of manufacture, main characteristics of the component or item and other significant information in compliance with applicable standards.

Labels shall be provided for equipment and devices mounted on control boards, cabinets, desks and other places as required for proper identification, as well as for operational, functional and safety reasons. The labelling, size of label-plates and their location shall be subject to approval by the Employer/Engineer. A sample label-plate (with indication of material used) with lettering shall be submitted for this purpose.

Where necessary, cautionary and warning plates and signs, shall be provided. Nameplates and warning plates shall be in English and in Nepali Language. Labels and VDU (Visual Display Unit) texts shall be in English.

All data, name plates, duty labels and instruction plates on cubicles with equipment shall be

in English.

6.4 FIRST FILL OF CONSUMABLES, OIL AND LUBRICANTS

All the first fill of consumables such as oils, lubricants, filling compounds, touch up paints, soldering/brazing material for all copper piping of circuit breakers and essential chemicals etc. which will be required to put the equipment covered under the scope of the specifications, into operation, shall be furnished by the Bidder unless specifically excluded under the exclusions in these specifications and documents.

6.5 BOLTS, STUDS, NUTS, SCREWS ETC.

All bolts, studs, nuts, and screws shall have standard threads and be of high-quality steel.

All bolts, studs, nuts and screws (including their washers) shall be protected against corrosion or made of stainless steel if so specified in Particular Technical Specifications and especially if the screw shall be hexagonal in shape and machine faced.

Nuts, bolts and screws, which might become loose during operation, shall be locked in fastened position by means which shall be approved by the Engineer.

Additionally, bolts, thread ends and the like shall be protected against condensation water or adverse climatic conditions by protective non-metallic caps with locking edge and sealing lip.

7.0 DESIGN IMPROVEMENTS / COORDINATION

7.1 The Bidder shall not make any changes to the equipment or to the material to be incorporated in the Plant from those specified or implied in the technical specification without the written approval of the Employer/Engineer. Any changes to be made due to unavoidable reason shall improve the performance of the plant or at least shall be of the same standard with same performance. Any changes or alterations shall in no way be detrimental to the interest of the Employer and shall not result in any increase to the Contract Price.

7.2 Deleted.

7.3 The Bidder shall be responsible for the selection and design of appropriate equipments to provide the best co-ordinated performance of the entire system. The basic design requirements are detailed out in this Specification. The design of various components, sub-assemblies and assemblies shall be so done that it facilitates easy field assembly and maintenance.

7.4 The Bidder has to coordinate designs and terminations with the agencies (if any) who are Engineer/Bidder for the Employer.

7.5 The Bidder will be called upon to attend design co-ordination meetings with the Engineer, other Bidder's and the Consultants of the Employer (if any) during the period of Contract. The Bidder shall attend such meetings at his own cost at mutually agreed venue as and when required and fully cooperate with such persons and agencies involved during those discussions.

8.0 QUALITY ASSURANCE PROGRAMME

8.1 The Bidder shall provide a complete description of the Quality Assurance system that he proposes to implement. The system shall include a quality assurance plan, quality assurance procedures and quality control procedures, in accordance with technical specification. An inspection and test plan for Electro-Mechanical equipment shall be provided. The plan and procedures shall cover the work of all subcontractors and sub vendors.

The Bidder and all of his suppliers or Sub-contractors shall have a fully established and efficient quality control system certified under IS09001. Should the Engineer, during his inspections or otherwise, determine that this system is not sufficiently effective, based on:

- formal errors in contradiction to the established procedures
- and/or manufacturing deficiencies and/or non-acceptable test results and missing tests
- The Engineer may, at his entire discretion and at full expense of the Bidder, impose such additional tests and inspections, as deemed necessary, to assure the quality of manufacturing and performance as stipulated by the terms of the Contract.

9.0 TYPE TEST

9.1 Type tests of major equipment/material/system as indicated under various chapters of the specifications shall be submitted with the bid, as applicable. For other major components, apparatus, equipment or devices, the Bidder shall submit complete type tests reports upon request by the Employer/Engineer. These test reports shall show that such tests have been successfully performed on same type and rating of apparatus, equipment or devices, appropriately witnessed by an independent institution.

If the Engineer shall find the tests incomplete or inconsistent with the provisions of the Contract, the Engineer shall be entitled to ask the Bidder, at the Bidder's expense, to carry out any of the type tests required in order to prove compliance with the requirements of the Contract.

In particular it must be proven by type tests that all dielectric, thermal and dynamic short circuit stresses as specified in the Contract will be met, that the permitted temperature rises will not be exceeded and that the required life times can be achieved.

The test results obtained on equivalent equipment shall be a confirmation of computer calculations if the Bidder wants to use calculations for proving of the guaranteed parameters of the equipment to be supplied.

10.0 TESTS AT MANUFACTURER'S WORKS

Before any material, equipment, aggregate, apparatus, systems etc. are packed or dispatched from the Bidder's or his Sub-contractor's works, all tests, inspections, checks, examinations, etc. required by the pertinent and internationally accepted standards, rules or codes shall be carried out, as far as practicable and agreed, in their premises.

All equipment, materials, aggregates, apparatus, systems and other parts or components of the works to be tested, inspected, checked, examined, etc. at the Bidder's or his Subcontractor's works shall be properly accessible for testing and inspection work. There shall be no interference or disturbance from other shop activities when conducting the tests and inspections.

It is to be understood that all equipment, materials, aggregates, apparatus, systems and other parts or components shall be adequately protected against weather whilst being tested, inspected, checked and examined.

Parts and components shall be assembled to the fairest possible and agreed extent, and dimensional checks shall be performed on all major assemblies, sub-assemblies, parts and components especially when close tolerances and fits are being involved (tolerance of shafts, clearance between stationary and moving parts, connecting dimensions for the assembly with other elements and supplies, combined functioning of electrical equipment/systems, etc.).

If dimensional checks show discrepancies in measurements, which may affect the fit transition clearances, assembly or dismantling of the respective part or component, immediate proper and workmanlike corrections or modification are a must.

Such corrections or modifications shall, however, in no way lead to reduction of reliability of operation or inter-changeability, and shall be performed only after the agreement of the Engineer has been obtained. If the correction or modification cannot be carried out in accordance with the terms mentioned above, the part or component concerned might be subject to rejection.

Doubtful, used, weak and faulty materials or products will also become automatically subject to rejection. Shop testing shall cover also the hydrostatic pressure testing of equipment, which can be finish-assembled in the Bidder's or his Sub-contractor's premises.

Standard equipment like circuit breakers and other apparatus shall be fully tested at the maker's works. If two or more identical items of such equipment are supplied, a complete performance test is to be carried out on the first unit only. Such performance test shall comprise the verification of rated and/or guaranteed data, like discharges against pressures, output, efficiency and other performance data requested in the specification. The corresponding test diagrams/procedures shall be provided. Subsequent units need to be tested only if test results obtained from the first unit prove doubtful or unsatisfactory.

Evidence and diagrams of previous "type-tests" undertaken on identical design of equipment like transformers, breakers and other apparatus may be acceptable instead of further complete performance tests, but the Engineer's approval must be sought in each case. A test at the rated performance point will, however, in any event be required.

Cubicles, cabinets and control boards shall, prior to their inspection and testing, be completely and definitely 'assembled, equipped and wired internally in the Bidder's or his Sub-contractor's shops.

Shop testing shall include functional tests on (as the case may be) partial or complete assemblies, as much as possible, as practicable and agreed. Such tests shall be performed under, as far as possible, operation-like conditions.

When requested by the Engineer the functional tests shall be repeated or extended until proof has been obtained that the functioning of the assemblies will comply with the requirements of the specifications.

11.0 PACKAGING & PROTECTION

11.1 General Requirement

11.1.1 The whole of the equipment/materials shall be packed or bundled properly so that no damage shall be sustained during transportation to the Site and by rough handling.

The contents of packing cases shall be securely bolted or fastened in position with struts or cross battens.

Wood-wool shall not be allowed for packing purposes.

Waterproof papers and felt linings shall overlap at seams and the seams secured together in an adequate manner, but the enclosure shall be provided with screened openings to obtain ventilation, wherever necessary.

All cases, packages, bundles, etc., shall bear at least the identification mark relating to the appropriate shipping documents, the contents and total weight.

Such shipping marks on the outside of casings or on the metal tags attached to bundles shall be protected by varnish etc.

Fragile or perishable materials shall be marked with the appropriate symbol, i.e. FRAGILE, HANDLE WITH CARE, COOL STORAGE and REEFER STORAGE and USE NO HOOKS.

When required due to length or unbalanced weight, containers or pieces shall have centre of balance indicated by painted stripe extending upward on each side with wording "CENTRE OF BALANCE".

Each case, package or bundle shall contain a packing list in a waterproof envelope and copies in triplicate shall be forwarded to the Employer/Engineer prior to dispatch. All items of material shall be clearly marked for easy identification against the packing list.

Dismantling shall be done into convenient sections, so that the weights and sizes are suitable for transport to Site and handling on the Site under the special conditions of the Project.

The Employer/Engineer reserves the right to inspect and approve the packing before the items are dispatched but the Bidder shall be entirely responsible for ensuring that the packing is suitable for transit and such inspection will not exonerate the Bidder from any loss or damage due to faulty packing.

11.1.2 All the equipments shall be suitably protected, coated, covered or boxed and crated to prevent damage or deterioration during transit, handling and storage at Site till the time of erection. On request of the Employer/Engineer, the Bidder shall also submit packing details/associated drawing for any equipment/material under his scope of supply, to facilitate the Employer to repack any equipment/material at a later date, in case the need arises. While packing all the materials, the limitation from the point of view of availability of Railway wagon sizes in India should be taken into account. The Bidder shall be responsible for any loss or damage during transportation, handling and storage due to improper packing. Any demurrage, wharfage and

other such charges claimed by the transporters, railways etc. shall be to the account of the Bidder. Employer takes no responsibility of the availability of the wagons.

11.1.3 All coated surfaces shall be protected against abrasion, impact, discolouration and any other damages. All exposed threaded portions shall be suitably protected with either a metallic or a non-metallic protecting device. All ends of all valves and pipings and conduit equipment connections shall be properly sealed with suitable devices to protect them from damage.

11.2 Marking

11.2.1 Shipping mark shall consist of the following information in sequence and in frame commensurate with the size of container:

(a) Consignee: The Managing Director
Raghuganga Hydropower Limited
Myagdi, Nepal
(b) Supplier's Identity
(c) Port of destination:
(d) Contract No:
(e) Package number:
(f) Item Code:
(g) Net and gross weight,
(h) Dimensions (cubic measurement):
(i) Markings for up right lifting:

12.0 FINISHING OF METAL SURFACES

The latest edition of the following codes, standards and specifications shall apply:

- SIS 055900 Swedish Corrosion Institute
- SSPC Steel Structures Painting Council
- DIN55928 DeutschesInstitut fill Normung
- BS 4232 British Standard
- ASTM Al23 American Society for Testing and Materials
- ASTM A153 American Society for Testing and Materials

12.1 All metal surfaces shall be subjected to treatment for anti-corrosion protection. All ferrous surfaces for external use unless otherwise stated elsewhere in the specification or specifically agreed, shall be hot-dip galvanized after fabrication. All steel conductors including those used for earthing/grounding (above ground level) shall also be galvanized.

12.2 GALVANISING

12.2.1 All materials shall be hot-dip galvanized after fabrication and cleaning. Re-tapping of nuts after galvanizing shall be is not required.

Galvanizing for structural mild steel products shall meet the requirements of ASTM A123.
All holes in structure shall be free of excess material after galvanizing.

Galvanizing for bolts, nuts, washers, lock nuts, step bolts and similar hardware shall meet requirements of ASTM A153. Excess galvanised material on bolts, nuts, washers, locknuts, step bolts and similar hardware shall be removed by appropriate means acceptable to Engineer.

Finished materials shall be dipped into the solution of dichromate after galvanizing for white rust protection during sea transportation.

Uniformity of Coating:

The uniformity of coating test shall be made in accordance with ASTM A239. The minimum repetition times for one-minute dip in uniformity test shall be as follows:

Steep shapes and plates	6
Bolts, nuts and similar hardware	4

Galvanizing Coating Weight

Description	Coating Weight (g/sq.m) Thickness		Uniformity test time (1 min. 1 time)
	Average Value	Minimum Value	
Shaped steel over 6mm	more than 700	more than 610	more than 6
Steel plates under 6mm	more than 610	more than 550	more than 6
Bolts. nuts & washers etc.	more than 470	more than 400	more than 4

Straightening after Galvanizing

All plates and shapes which have been warped by the galvanizing process shall be straightened by being re-rolled or pressed. The materials shall not be hammered or otherwise straightened in a manner that will injure the protective coating. If, in the opinion of Employer/Engineer, the material has been hard fully bent or warped in the process of galvanizing or fabrication, such defects shall be cause for rejection.

Repair of Galvanizing

Materials on which galvanizing has been damaged shall be acid stripped and re-galvanized, unless, in the opinion of Employer/Engineer, the damage is local and can be repaired by zinc spraying or by applying a coating of galvanizing repair compound. Where re-galvanizing is required, any member, which becomes damaged after having been dipped twice, shall be rejected.

12.2.2 Galvanised material must be transported properly to ensure that galvanised surfaces are not damaged during transit. Application of touch-up zinc rich paint at site shall be allowed with approval of Engineer Incharge.

12.3 PAINTING

12.3.1 The colours of painted external surfaces of equipment and structures shall be in accordance with the RAL, Colour Code. Coating shall be especially resistant to mechanical knocks, pressure

variations, temperature changes and vibrations, etc. For internal surfaces the Bidder shall avoid using contaminating fluids coming in contact with them.

12.3.2 All surfaces to be painted shall be thoroughly cleaned of all dirt, dust, grease, cement scale or oil before the application of paint. Oil and grease shall be removed with solvents not harmful to the surface. If required by the paint system, the surface shall be finally cleaned with water. Surfaces shall be dry unless dampening is required for a particular finish material. Any surface contaminated during paint application shall be re-cleaned thoroughly before painting is being continued.

12.3.3 Surface Preparation

All surfaces to be painted shall be thoroughly cleaned by suitable means before application of paint. After cleaning the surfaces will be rinsed so that no residue will remain. Primed surfaces contaminated with oil or grease shall be de-greased in a manner not affecting the quality of the primer. 2-component coatings older than six (6) months must be roughened prior to application of the next coat.

12.3.4 Finishing Coats

Whenever specific colouring is required or where priming is not sufficient protection against corrosion a finishing coat shall be applied. If not otherwise specified, finishing coats shall only be applied to primed surfaces. The primed surface shall be prepared as specified above in Sub-Clause12.3.3 Surface Preparation. Selection of finishing coats with regard to quality and quantity shall be governed by the ambient conditions and its effect on the painted surface.

The Engineer will select the type and shade of colouring in accordance with the RAL colour code. For this purpose the Bidder shall submit colour cards or colour samples. On request of the Engineer colour samples shall be applied to the surface to be painted. Colour selection and/or painting procedure limitations, will be duly considered by the Engineer as long as such limitations have been declared in the offer (Deviation Schedule) and accepted by the Employer/Engineer.

12.3.5 Painting Specification

The various items and equipment shall be protected against corrosion as specified in the following:
Wetted surfaces

All steel surfaces in contact with water etc. shall be protected as follows:
Surface preparation: B Sa 2 1/2 (SIS)
Prime coat: 1 x 2-component epoxy zinc rich primer
Dry film thickness 50 microns.
Finish coat: 2 x 2-component tar-epoxy, colour
black/brown/black
Dry film thickness 2 x 150 microns 300 microns
Total dry film thickness = 350 microns.

External surfaces

i. Not exposed to sunlight:

Surface preparation: B Sa 2 1/2 (SIS)

All such surfaces of breakers, etc. shall receive within two (2) hours after sand-blasting and mechanical cleaning of the respective surfaces up to the sound and base metal, one first layer of priming paint (minimum dry film thickness: 40 micrometers) followed by two (2) priming layers having a minimum dry film thickness of 30 micrometers each. All these layers shall be of red lead on chlorinated rubber/synthetic resin basis (minimum total dry film thickness: 100 micrometers). Final coating shall be with 2 finishing coats (minimum dry film thickness: 30 micrometers each) on chlorinated rubber/synthetic resin basis.

ii. All steel surfaces exposed to sunlight shall be protected as follows:

Surface preparation: B Sa 2 1/2 (SIS)

Prime coat: 2 x 2-component epoxy zinc rich primer
Dry film thickness 2 x 50 ie. 100 microns
Finish coat: 2 x 2-component epoxy m.i.o. paint.
Dry film thickness 2 x 50 ie. 100 microns
Total dry film thickness = 200 microns.

Oil tanks
Inside surfaces:
Surface preparation: B Sa 2 1/2 (SIS)
Finish coat: 2 x 2-component epoxy high build paint.
Dry film thickness 2 x 220 = 440 microns.

External surfaces:
As specified in above sections.

Indoor Cubicles and cabinets
After careful cleaning and degreasing all cubicles and cabinets shall be given an automatic "electrophorese" paint coating inside and outside as follows:
Steel sheets prepared with a Zn-Decordal coat shall receive 2 coats of 2-component Acryresin-varnish, each coat min. 30 microns.

13.0 LANGUAGE

English shall be understood to mean English as normally spoken and written in the United Kingdom. In all technical correspondence between the Bidder and the Employer/Engineer/BHEL and whenever anything is required under the terms of the Contract to be written, marked, or printed, the English language shall be used except where otherwise provided in the Specifications.

Warning and safety notices, plant labels and rating plates and all permanent or temporary notices around the plant shall be in English and in Nepali language, or as agreed with the Employer and Engineer.

Instruction Manuals and the training programmes shall be in English.

The visual display unit outputs given by the computer - driven data acquisition system shall be in English only.

14.0 TOOLS

14.1 Deleted

14.2 SPECIAL TOOLS AND TACKLES

The bidder shall supply all special tools and tackles required for Operation and maintenance of equipment. The special tools and tackles shall only cover items which are specifically required for the equipment offered and are proprietary in nature. The list of special tools and tackles, if any, shall be finalized during detail engineering and the same shall be supplied without any additional cost implication to the Employer. The maintenance equipment and special tools shall be supplied in lockable cabinet(s) fitted internally so that the tools may be safely stored in an orderly manner.

14.3 Deleted

15.0 AUXILIARY SUPPLY

15.1 The Electrical Power for Permanent Equipment

- 11kV, 50 Hz, three-phase system, solidly-earthed neutral, 11kV line from powerhouse to head works/valve chamber with inter connection of this line to the under construction 11kV line to camp (by tapping existing line running adjacent to switchyard)
- 400/230 V, 50 Hz, three-phase system with earthed neutral for feeding three-phase and single-phase loads for lighting, indication, motor control and similar small power circuits for power circuits.
- 400/230 V, 50 Hz, permanent supply, three phase/single phase, earthed (UPS).
- 110 V, DC system, isolated from earth, for the supply of auxiliary and main control circuits, DC motors, DC/AC inverters permanent supply etc.
- 48 V DC system, (by providing 110/48 V DC to DC converter), isolated from earth, for the supply of electronic equipment, tele-control, tele-communications, clock systems, etc.

15.2 Supply Tolerances

Parameters	400/230 V	UPS	110V DC	48V DC
Supply voltage Limits	±10%	±2%	+10/-15%	+10/-15%
Frequency Limits Steady	± 5%	± 1%		

16.0 SUPPORT STRUCTURE

16.1 The equipment support structures shall be suitable for equipment connections at the first level i.e 5.9 meter from plinth level for 220kV substations. All equipment support structures shall be supplied alongwith brackets, angles, stools etc. for attaching the operating mechanism, control cabinets & marshalling box (wherever applicable) etc.

16.2 The minimum vertical distance from the bottom of the lowest porcelain part of the bushing, porcelain enclosures or supporting insulators to the bottom of the equipment base, where it rests on the foundation pad shall be 2.55 metres.

17.0 CLAMPS AND CONNECTORS INCLUDING TERMINAL CONNECTORS

17.1 All power clamps and connectors shall conform to IS: 5561 or other equivalent international standard and shall be made of materials listed below:

S.No.	Description	Materials
a)	For connecting ACSR conductors/AAC conductors/ Aluminium tube	Aluminum alloy casting, conforming to designation A6 of IS:617 and all test shall conform to IS:617
b)	For connecting equipment terminals mad of copper with ACSR conductors/AAC conductors/ Aluminium tube	Bimetallic connectors made from aluminum alloy casting, conforming to designation A6 of IS:617 with 2mm thick bimetallic liner/strip and all test shall conform to IS:617
c)	For connecting G.I	Galvanised mild steel shield wire
d)	Bolts, nuts & plain washers	Electro-galvanised for sizes below M12, for others hot dip galvanised.
e)	Spring washers	Electro-galvanised mild steel suitable for atleast service condition-3 as per IS:1573

17.2 Necessary clamps and connectors shall be supplied for all equipment and connections. If corona rings are required to meet these requirements they shall be considered as part of that equipment and included in the scope of work.

17.3 Where copper to aluminum connections are required, bi-metallic clamps shall be used, which shall be properly designed to ensure that any deterioration of the connection is kept to a minimum and restricted to parts which are not current carrying or subjected to stress.

17.4 Low voltage connectors, grounding connectors and accessories for grounding all equipment as specified in each particular case, are also included in the scope of Work.

17.5 No current carrying part of any clamp shall be less than 10 mm thick. All ferrous parts shall be hot dip galvanised. Copper alloy liner/strip of minimum 2 mm thickness shall be cast integral with aluminum body or 2 mm thick bi-metallic liner/strips shall be provided for Bi-metallic clamps.

17.6 All casting shall be free from blow holes, surface blisters, cracks and cavities. All sharp edges and corners shall be blurred and rounded off.

17.7 Flexible connectors, braids or laminated straps made for the terminal clamps for bus posts shall be suitable for both expansion or through (fixed/sliding) type connection of IPS AL tube as required. In both the cases the clamp height (top of the mounting pad to centre line of the tube) should be same.

17.8 Current carrying parts (500A and above) of the clamp/connector shall be provided with minimum four numbers of bolts preferably for 132kV & above.

17.9 All current carrying parts shall be designed and manufactured to have minimum contact resistance.

17.10 Power Clamps and connectors shall be designed to control corona as per requirement.

17.11 Deleted

18.0 CONSTRUCTIONAL REQUIREMENTS FOR CUBICLES/PANEL BOARDS/CABINETS

Switchboards, control, relay and metering panel boards shall be of robust, industrial type design and manufacture, formed of a steel frame and covered with smooth steel plate. The steel plate shall be sufficiently thick and properly stiffened to prevent distortion. If required, flush mounted hinged steel doors with latches shall be provided. Doors shall be of lockable type by means of approved key-locks. The key-locks shall be of a key system identical throughout the power plant and switchyard/substation, as approved by the Engineer.

All cubicles shall be fully enclosed and protected according to the protection class given in the equipment specification. The lowest degree of protection shall be IP 40.

The frames of the cubicles shall be designed to permit firm anchoring on the floor or on the cable ducts or trenches. The frames shall permit easy erection, and allowance shall be made for extension of the cubicles in each direction with additional similar ones.

All cubicles and panel boards shall be properly designed for being inaccessible to rats, lizards or other small reptile or animals to avoid accidents/disturbances, mal-operation/faults.

The Bidder's supply shall include all necessary mounting brackets, framing, foundation bolts and related embedded metal works to permit proper installation of the cubicles.

The bottom parts of the cubicles must be closed with metal bottom plates and cable entrances must be fitted with glands.

19.0 TROPICALIZATION

In choosing materials and their finishes, due regard shall be given to the humid tropical conditions under which the power plant/switchyard will work. The Bidder shall submit, upon the Engineer's request, details of his practices which have proven satisfactory and which he recommends for application on the parts of the work which may be affected by the tropical conditions. The materials and finishes used shall be approved by the Employer/Engineer.

20.0 WIRING, TERMINAL BLOCKS AND MARKING

20.1 All wiring shall be stranded conductor, XLPE/PVC or equivalent insulated, suitable for operation at voltages below 1000 V in compliance with the provisions of the applicable IEC recommendations. An exception to minimum cross section requirements is the wiring and multi-core cabling of electronic equipment, where solid wires of smaller cross sections and modern means of connection like wire-wrap may be used.

For wiring within boards, the "bunch" pattern shall be adopted. For a small number of connections, wiring may be grouped using flexible plastic ties or equivalent, for a large number of connections a system using support strips or U-shaped troughs (with covers) shall be used. The latter arrangement shall apply in particular for cable distribution racks. All apparatus inside cubicles shall be clearly marked and identified.

For wiring of electronic equipment between racks and to terminals the front side pin and socket connection with flexible multi-core cables shall be the preferred method. The multicore cables shall be connected at the other end to terminal blocks in the cubicles.

All wiring leaving the cubicle shall be connected to terminal blocks, and shall be clearly marked with their respective destination points for easy testing and repair. These shall be of the moulded type and provided with barriers to separate power from control cables. Special precautions shall be observed for electronic equipment to avoid damage to the printed circuit boards during testing or maintenance and to avoid interference. It shall be possible to exchange a single terminal block for a new one without dismantling a whole row. Where appropriate terminal blocks shall be equipped with facilities for testing, such as short circuiting, separating, plugging-in etc. Terminal blocks shall be located at least 300 mm above the bottom of the cubicle and shall be easily accessible. They shall be clearly marked, the designations being those entered in the respective wiring diagrams.

Terminal blocks using screws acting directly on the wire (conductor) as well as spring type terminal blocks are not acceptable. To avoid squeezing of the wire the screw pressure shall be applied by a pressure plate having smooth edges.

21.0 LAMPS & SOCKETS

21.1 Lamps & Sockets
Shall be as per approved drawings.

21.2 Hand Lamp:
Shall be as per approved drawings.

21.3 Switches and Fuses:

21.3.1 Each panel shall be provided with necessary arrangements for receiving, distributing, isolating and fusing of DC and AC supplies for various control, signalling, lighting and space heater circuits. The incoming and sub-circuits shall be separately provided with miniature circuit breaker / switch fuse units. Selection of the main and Sub-circuit fuse ratings shall be such as to ensure selective clearance of sub-circuit faults. Potential circuits for relaying and metering shall be protected by HRC fuses.

21.3.2 All fuses shall be of HRC cartridge type conforming to relevant standard mounted on plug-in type fuse bases. Miniature circuit breakers with thermal protection and alarm contacts will also be accepted. All accessible live connection to fuse bases shall be adequately shrouded. Fuses shall have operation indicators for indicating blown fuse condition. Fuse carrier base shall have imprints of the fuse rating and voltage.

22.0 Bushings, Hollow Column Insulators, Support Insulators – (For Porcelain Type Only):

22.1 Deleted

22.2 Support insulators, bushings and hollow column insulators shall be manufactured from high quality porcelain, as applicable. Porcelain used shall be homogeneous, free from laminations, cavities and other flaws or imperfections that might affect the mechanical or dielectric quality and shall be thoroughly vitrified tough and impervious to moisture.

22.3 Glazing of the porcelain shall be uniform brown in colour, free from blisters, burrs and similar other defects.

22.4 Support insulators/bushings/hollow column insulators shall be designed to have ample insulation, mechanical strength and rigidity for the conditions under which they will be used.

22.5 When operating at normal rated voltage there shall be no electric discharge between the conductors and bushing which would cause corrosion or injury to conductors, insulators or supports by the formation of substances produced by chemical action. No radio interference shall be caused by the insulators/bushings when operating at the normal rated voltage.

22.6 Bushing porcelain shall be robust and capable of withstanding the internal pressures likely to occur in service. The design and location of clamps and the shape and the strength of the porcelain flange securing the bushing to the tank shall be such that there is no risk of fracture. All portions of the assembled porcelain enclosures and supports other than gaskets, which may in any way be exposed to the atmosphere shall be composed of completely non hygroscopic material such as metal or glazed porcelain.

22.7 All iron parts shall be hot dip galvanised and all joints shall be air tight. Surface of joints shall be trued up porcelain parts by grinding and metal parts by machining. Insulator/bushing design shall be such as to ensure a uniform compressive pressure on the joints.

22.8 Tests

In bushing, hollow column insulators and support insulators shall conform to type tests and shall be subjected to routine tests in accordance to relevant standard.

22.9 **Deleted**

23.0 MOTORS

For all electric power drives, three-phase, squirrel-cage type induction motors complying fully with IEC recommendations shall be used. All motors shall be of the totally enclosed, externally cooled (fan cooled) type IP44. Winding insulation shall be Class F throughout.

Starting shall be direct-on-line with starting currents not exceeding 6 times the rated current. However, for motors being large in relation to the feeding transformer, suitable automatic change-over starters shall be provided.

All motors shall be so designed that start-up can be affected successfully at 85% of the rated voltage of the motor. The motors shall be designed to operate continuously without overheating at 400 V ±10%.

Special attention shall be paid when designing the electric motors on account of the temporary frequency rises, which may arise in the motor feeding voltage during full load shedding of the turbines. The motors shall, therefore, be tested for over speeds of not less than 40% of their rated speed.

When connecting differing materials, material transition plates will, in general, be inserted. All connecting materials will be corrosion-proof and suitable for the conditions prevailing at the installation point.

Unless otherwise stipulated in Particular Technical Specification of all materials subject to penstock pressure shall have impact strength (Charpy V-notch) of not less than 35 J/crn^2 (at 0°C) whereby this figure shall be the minimum of each of 3 specimens. For steel plates this figure shall be understood for the transverse direction.

Materials for various components including the standard are presented below in the table.

Component	Material	Standard
Runners	G-X5 Cr Ni 13-4	(DIN No. 1.4313)
Labyrinth and wearing rings	G-X 22 Cr Ni 17	(DIN No, 1.4059)
Shafts	Ck 35	(DIN No. 1.1181)
Cast iron (depending on application)	GG-15 GG-20 GG-25 GG-30 GG-35	(DIN No. 0.6015) (DIN No. 0.6020) (DIN No. 0.6025) (DIN No. 0.6030) (DIN No. 0.6035)
Modular cast iron (depending on application)	GGG-40 GGG-50 GGG-60 GGG-70	(DIN No. 0.7040) (DIN No. 0.7050) (DIN No. 0.7060) (DIN No, 0.7070)
Malleable iron castings	GTW-35} GTW-40	as per DIN standard 1692
Carbon steel castings	GS-45.3 GS-52 GS-20 Mn 5	(DIN No. 1.0446) (DIN No. 1.0551) (DIN No. 1.1133)
Forged carbon steel flanges for up to 20 bars above 20 bars	 R St 37-2 R St 42-2	 (DIN No. 1.0114) (DIN No. 1.0134)
Cast steel flanges	GS 45	(DIN No, 1.0443)
Bolt material	5.6 8.8	As per DIN standard 67
Nut material	4.8 for 5.6 bolts 6.8 for 8.8 bolts	
Stainless steel bolts & nuts bolts nuts	 X20 Cr 13 X10 Cr 13	 (DIN No. 1.4021) (DIN No. 1.4006)
Steel plates (depending on application)	St 360-3 St 430-2 TT St E 26 TT St E 32	(DIN No. 1.0116 (DIN No. 1.0044) (Material No.1.046) (Material No.1.085)
(Note: Steel plates shall have the following characteristics: non ageing, notch-tough, killed, free from segregation and good weld-ability)		

Component	Material	Standard
Steel pipes	welded St 33-1 seamless St 35	(DIN No. 1.0033) (DIN No. 1.0308)
Seamless stainless pipes	X.5 Cr Ni 189 X20 Cr 13 X10 Cr Ni Ti 189	(DIN No. 1.4301) (DIN No. L4021) (DIN No. 1.4541)
Tin bronze	SnBz 6 SnBz 8 G-Cu Sn 10 G-Cu Sn 12	(DIN No. 2.1020) (DIN No. 2.1030) (DIN No. 2.1050.01) (DIN No. 2.1052.01)
Aluminium alloy bronze	G-Fe Al Bz F 50 G-Ni Al Bz F 60	(DIN No. 2.0940.01) (DIN No. 2.0975.01)
Gun metal	G-Cu *Sn 5* Zn Pb G-Cu Sn 10 Zn	(DIN No. 2.1096.01) (DIN No. 2. 1086.01)
Brass pipes	So Ms 58 AI 1	(DIN No. 2.0560)
Babbit Material (for bearings)	LgPbSn 10 LgPb*Sb*12 LgSn 80 LgSn 90	as per DIN standard 1703 (DIN No. 2.3770) (DIN No. 2.3775)

In particular for the mechanical parts of these equipment, the above material specifications shall be used wherever applicable.

All material, components, supplies and articles not manufactured by the Contractor shall be products of recognized and/or reputed manufacturers.

Samples of the materials contemplated for incorporation in the Works, together with performance capacity data and other significant information pertaining to the material shall be furnished to the Employer/Engineer for approval. Materials installed or used without such approval shall be at the risk of subsequent rejection.

Material tests shall be conducted at the manufacturer's premises or at other places agreeable to the Employer/Engineer, in accordance with the requirements of the DIN standards or other appropriate and agreed standards. The results of these tests shall be in such a form as to provide a means of determining compliance with the applicable specifications for the material tested.

Where the Contractor desires to use stock material not manufactured specifically for the Works, satisfactory evidence that such material conforms to the requirements stated in the Contract shall be furnished to the Employer/Engineer, in which case tests on these materials may be waived. In such a case it will be essential that the purchase, testing, marking and stocking of such material had been supervised by an established quality control system. Relevant documents in this regard would need to be submitted.

The cost of performing all of the material tests and the supply of samples shall be fully borne by the Contractor.

4.2.1.5 Cubicles (Marshalling Box) for Switchyard bays

4(four) cubicles, one for each bay for integrated connection of circuit breaker cubicles, instrument transformer cubicle and any interlocks. This cubicle is also intended to facilitate internal wiring for control circuits, measurements and signalling including terminal strips for external connections.

4.3 TECHNICAL REQUIREMENT

4.3.1 Information

The following Technical Specifications cover high-voltage switchgear equipment intended for outdoor installation, including related steel structures and non slip finish steel cable trench cover. One circuit of 220 kV double circuit transmission line from dana to Kushma (under the scope of separate Kaligandaki Transmission Corridor Project of NEA) shall be LILOed at take-off gantry in the switchyard. Layout of all equipment and foundation loads shall be as per requirement of the Contractor. However, all the foundation and other civil works including development or switchyard shall be under the scope of Lot 1 Contractor.

4.3.1.1 Applicable IEC Standards

60038	IEC standard voltages
60044	Instrument Transformers
60050	International Electro-technical Vocabulary
60060	High-voltage test techniques
60071	Insulation coordination
60099	Surge arresters
60104	Aluminium-magnesium-silicon alloy wire for overhead line conductors
60168	Tests on indoor and outdoor post insulators of ceramic material or glass for systems with nominal voltages greater than 1000 V
60265	High-voltage switches
60273	Characteristics of indoor and outdoor post insulators for systems with nominal voltages greater than 1000 V
60305	Characteristics of string insulator units of the cap and pin type
60358	Coupling capacitors and capacitive dividers
60383	Insulators for overhead lines with a nominal voltage above 1000 V
60427	Synthetic testing of high-voltage alternating current circuit-breakers
60437	Radio interference test on high-voltage insulators
60466	A.C. insulation-enclosed switchgear and control gear for rated voltages above 1 kV and up to and including 38 kV
60470	High-voltage alternating current contactors and contactor-based motor-starters

60471	Dimensions of clevis and tongue couplings of string insulator units
60507	Artificial pollution tests on high-voltage insulators to be used on a.c. systems
60575	Thermal-mechanical performance test and mechanical performance test on string insulator units
60694	Common specifications for high-voltage switchgear and controlgear standards
60720	Characteristics of line post insulators
60815	Guide for the selection of insulators in respect of polluted conditions
60865	Short-circuit currents - Calculation of effects
60889	Hard-drawn aluminium wire for overhead line conductors
60932	Additional requirements for enclosed switchgear and controlgear from 1 kV to 72.5 kV to be used in severe climatic conditions
61089	Round wire concentric lay overhead electrical stranded conductors
61109	Insulators for overhead lines-Composite suspension and tension insulators for AC systems with a normal voltage greater than 1000V-Definitions, test methods and acceptance criteria
61166	High-voltage alternating current circuit breakers - Guide for seismic qualification of high-voltage alternating current circuit-breakers
61633	High-voltage alternating current circuit breakers - Guide for short-circuit and switching test procedures for metal-enclosed and dead tank circuit breakers
61634	High-voltage switchgear and controlgear - Use and handling of sulphur hexafluoride (SF6) in high-voltage switchgear and controlgear
61958	High-voltage prefabricated switchgear and controlgear assemblies - Voltage presence indicating systems
62063	High-voltage switchgear and controlgear - The use of electronic and associated technologies in auxiliary equipment of switchgear and controlgear
62155	Hollow pressurized and unpressurized ceramic and glass insulators for use in electrical equipment with rated voltages greater than 1000 V
62271	High-voltage Switchgear and Controlgear

4.3.2 Switchyard Arrangement

4.3.2.1 Insulation clearances

Unless otherwise agreed between the Employer and the Contractor, the insulation clearances shall be as per applicable standard mentioned above.

bushings, clamps and connections, earth wires, operating devices, fixing materials, apparatus supports, galvanised steel structures for 220 kV lines in switchyard.

The "bid" shall include all associated equipment and accessories to complete the specified scope of works in existing site situations. Such costs (if any) shall be included in the relevant items in the Price Schedules.

The Contractor shall perform requisite power system studies to select short circuit ratings of bus bars/switchgears, impulse voltage ratings of switchgears etc. Requisite studies for appropriate location/characteristics for the surge arresters at various locations (near transformers, outgoing line bays etc.) in switchyard shall also be done by the bidder.

Design calculations for the outdoor tubular bus-bars, equipment support structures, take-off structures etc shall be provided after accounting for all the loadings including seismic and short circuit forces as per relevant standards.

The contractor shall submit detailed layout & sectional drawing of switchyard showing locations of transformers & firewalls, equipment/rigid busbars with bus post insulators/support structures, cable trenches, transformer soak pits, waste oil-water sump, power house approach road with embedded rails extending into service bay and to location of transformers, take-off gantry, fencing, gates etc.

4.2 EQUIPMENT SPECIFICATION

4.2.1 Switchyard Equipment

4.2.1.1 General

The configuration of the switchyard shall make it possible looping loop out arrangement in a single bus-bar arrangement within the confined place adjacent to the power house. The supply shall include steel structure necessary for equipment support as well as take off and internal gantry arrangement.

a) General arrangement has been shown in the Single Line Diagram of main circuit drawing No. RG-EL-015

b) Frequency: All switchgear and control shall be designed for a frequency of 50 Hz.
Insulation Level: The switchgear shall withstand the following voltages:

(1)	Full wave impulse- 1.2/50 micro-seconds	1050 kVp
(2)	Power frequency Dry for one minute	460 kV
(3)	Power frequency Wet for 1 minute	460 kV
(4)	Corona extinction voltage	156 kV

c) Insulating oil:
Insulation oil required for the oil filled electrical equipment to be furnished and installed under this section shall be of non-sludge and medium viscosity type. The

Contractor shall state the characteristics and standard of the insulation oil in his Tender. The proposed oil shall be available in Nepal.

d) Indicating lights:
Red indicating lights shall be used for "ON" position and green lights for "OFF" position. White indicating lights shall be use to indicate that a change in switch position

has been ordered and shall light up with red or green light indicating the switch position before the change. On completion of the change only red or green light will stay lit.

e) Name plates and escutcheon Plates:
All escutcheon plates shall be written in the English language.

f) Electric Supply

Electric supply for controls, drives and lights shall be as follows:

400-230 volt, A.C. three-phase, four wire system, from the station auxiliary supply covered under Chapter-8.

110 volt, D.C. from storage battery covered under Chapter-8.

g) Porcelain Insulator and Fittings:

The colour of porcelain insulators to be mounted inside cubicle or enclosure and for outdoor switchgear equipment shall be brown and the glazed surface shall be free from bulges, hairline cracks and other defects.

All fittings shall be of malleable iron hot dip galvanized or of copper alloy.

h) Electrical and Mechanical Design:

Switchgear equipment including rigid bus bars shall be designed electrically to avoid local corona formation and discharge likely to cause radio interference, and shall be designed mechanically to endure short circuit current without thermal and mechanical failure for two (2) seconds. All cubicles and enclosures shall be of vermin proof, dust gap proof and, where required of weatherproof.

i) Tests

The tests to be carried out before shipment at the Contractor's works are stated in the relevant Clauses herein. The tests at Site shall be carried out in accordance with Clause 33.9 of the General Technical Specification.

4.2.1.2 Busbars

a. 220 kV

The supply shall include one three-phase 220 kV tubular bus-bar assembly for min. 2000 A nominal current and 40/50 kA (as applicable) short circuit current, for the following connecting/circuits etc as per arrangement shown in switchyard layout drawing:

2 (two) incoming circuits from generator transformers,

2 (two) outgoing circuits for LILO of one circuit of 220 kV D/C Dana-Kushma line (under separate 220 kV Transmission Corridor Project),

3 (three) single phase voltage transformers connected to three phases of the bus with measuring and protection winding.

Ratio: $\frac{220}{\sqrt{3}}/\frac{0.11}{\sqrt{3}}/0.1\,1\text{kV}$

4.2.1.3 Outgoing Circuits

Each of the two 220 kV circuits of Dana-Kushma LILO line shall have the following equipment:

- 3 single phase 220 kV circuit breakers (three separate poles equipped with single pole control mechanism) with the following ratings:

  Rated voltage 245 kV
  Rated current 1600 A
  Breaking capacity 40/50 kA

- 2(two) three-phase disconnecting switches and 1 (one) three phase earth switch
  Rated voltage 245 kV
  Rated current 1600 A
  Breaking capacity 40/50 kA
  Rated dynamic S.C
  Current withstand 100kAp

- 3 (three) single phase current transformers with measuring cores and protection cores (ratio, accuracy class as per SLD).

- 3 (three) single phase capacitor voltage transformers, three-phase connected.

  Ratio: $\frac{220}{\sqrt{3}}/\frac{0.11}{\sqrt{3}}/\frac{0.11}{\sqrt{3}}/0.1\,1\text{kV}$

  Measuring winding Class 0.2
  Protection winding Class 0.2 & 3P

- 3 (three) lightning arresters with surge counters

4.2.1.4 Incoming Circuits

a) Each of the two incoming circuits from generator transformers shall have the following equipment:

- 1 (one) three phase circuit breaker
- 1 (one) three-phase disconnecting switch and 1 (one) three phase earth switch

} Ratings as per SLD

- 3 (three) single phase current transformers with measuring core and protection cores (ratio, accuracy class as per SLD).

Annexure-1

INTEGRITY PACT

Between

Bharat Heavy Electricals Ltd. (BHEL), a company registered under the Companies Act 1956 and having its registered office at "BHEL House", Siri Fort, New Delhi - 110049 (India) hereinafter referred to as "The Principal", which expression unless repugnant to the context or meaning hereof shall include its successors or assigns of the ONE PART

and

_____, (description of the party along with address), hereinafter referred to as "The Bidder/ Contractor" which expression unless repugnant to the context or meaning hereof shall include its successors or assigns of the OTHER PART

Preamble

The Principal intends to award, under laid-down organizational procedures, contract/s for _____

_____

_____ (hereinafter referred to as "Contract"). The Principal values full compliance with all relevant laws of the land, rules and regulations, and the principles of economic use of resources, and of fairness and transparency in its relations with its Bidder(s)/ Contractor(s).

In order to achieve these goals, the Principal will appoint panel of Independent External Monitor(s) (IEMs), who will monitor the tender process and the execution of the contract for compliance with the principles mentioned above.

Section 1- Commitments of the Principal

1.1 The Principal commits itself to take all measures necessary to prevent corruption and to observe the following principles: -

1.1.1 No employee of the Principal, personally or through family members, will in connection with the tender for, or the execution of a contract, demand, take a promise for or accept, for self or third person, any material or immaterial benefit which the person is not legally entitled to.

1.1.2 The Principal will, during the tender process treat all Bidder(s) with equity and reason. The Principal will in particular, before and during the tender process, provide to all Bidder(s) the same information and will not provide to any Bidder(s) confidential/ additional information through which the Bidder(s) could obtain an advantage in relation to the tender process or the contract execution.

1.1.3 The Principal will exclude from the process all known prejudiced persons.

1.2 If the Principal obtains information on the conduct of any of its employees which is a penal offence under the Indian Penal Code 1860 and Prevention of Corruption Act 1988 or any other statutory penal enactment, or if there be a substantive suspicion in this regard, the Principal will inform its Vigilance Office and in addition can initiate disciplinary actions.

Section 2 - Commitments of the Bidder(s)/ Contractor(s)

2.1 The Bidder(s)/ Contractor(s) commit himself to take all measures necessary to prevent corruption. The Bidder(s)/ Contractor(s) commits himself to observe the following principles during participation in the tender process and during the contract execution.

2.1.1 The Bidder(s)/ Contractor(s) will not, directly or through any other person or firm, offer, promise or give to the Principal or to any of the Principal's employees involved in the tender process or the execution of the contract or to any third person any material, immaterial or any other benefit which he/ she is not legally entitled to, in order to obtain in exchange any advantage of any kind whatsoever during the tender process or during the execution of the contract.

2.1.2 The Bidder(s)/ Contractor(s) will not enter with other Bidder(s) into any illegal or undisclosed agreement or understanding, whether formal or informal. This applies in particular to prices, specifications, certifications, subsidiary contracts, submission or non-submission of bids or any other actions to restrict competitiveness or to introduce cartelization in the bidding process.

2.1.3 The Bidder(s)/ Contractor(s) will not commit any penal offence under the relevant Indian Penal Code (IPC) and Prevention of Corruption Act; further the Bidder(s)/ Contractor(s) will not use improperly, for purposes of competition or personal gain, or pass on to others, any information or document provided by the Principal as part of the business relationship, regarding plans, technical proposals and business details, including information contained or transmitted electronically.

2.1.4 Foreign Bidder(s)/ Contractor(s) shall disclose the name and address of agents and representatives in India and Indian Bidder(s)/ Contractor(s) to disclose their foreign principals or associates. The Bidder(s)/ Contractor(s) will, when presenting his bid, disclose any and all payments he has made, and is committed to or intends to make to agents, brokers or any other intermediaries in connection with the award of the contract.

2.2 The Bidder(s)/ Contractor(s) will not instigate third persons to commit offences outlined above or be an accessory to such offences.

2.3 The Bidder(s)/ Contractor(s) shall not approach the Courts while representing the matters to IEMs and shall await their decision in the matter.

Section 3 - Disqualification from tender process and exclusion from future contracts

If the Bidder(s)/ Contractor(s), before award or during execution has committed a transgression through a violation of Section 2 above, or acts in any other manner such as to put his reliability or credibility in question, the Principal is entitled to disqualify the Bidder(s)/ Contractor(s) from the tender process , terminate the contract, if already awarded, exclude from future business dealings and/ or take action as per the separate "Guidelines on Banning of Business dealings with Suppliers/ Contractors", framed by the Principal.

Section 4 - Compensation for Damages

4.1 If the Principal has disqualified the Bidder (s) from the tender process before award / order acceptance according to Section 3, the Principal is entitled to demand and recover the damages equivalent to Earnest Money Deposit/ Bid Security.

4.2 If the Principal is entitled to terminate the Contract according to Section 3, or terminates the Contract in application of Section 3 above , the Bidder(s)/ Cotractor (s) transgression through a violation of Section 2 above shall be construed breach of contract and the Principal shall be-entitled to demand and recover from the Contractor an amount equal to 5% of the contract value or the amount equivalent to Security Deposit/ Performance Bank Guarantee , whichever is higher, as damages, in addition to and without prejudice to its right to demand and recover compensation for any other loss or damages specified elsewhere in the contract.

Section 5 - Previous Transgression

5.1 The Bidder declares that no previous transgressions occurred in the last 3 (three) years with any other company in any country conforming to the anti-corruption approach or with any other Public Sector Enterprise in India that could justify his exclusion from the tender process.

5.2 If the Bidder makes incorrect statement on this subject, he can be disqualified from the tender process or the contract, if already awarded, can be terminated for such reason or action can be taken as per the separate "Guidelines on Banning of Business dealings with Suppliers/ Contractors", framed by the Principal.

Section 6 - Equal treatment of all Bidder (s)/ Contractor (s) / Sub-contractor (s)

6.1 The Principal will enter into Integrity Pacts with identical conditions as this Integrity Pact with all Bidders and Contractors.

6.2 In case of Sub-contracting, the Principal Contractor shall take the responsibility of the adoption of Integrity Pact by the Sub-contractor(s) and ensure that all Sub-contractors also sign the Integrity Pact.

6.3 The Principal will disqualify from the tender process all Bidders who do not sign this Integrity Pact or violate its provisions.

Section 7 - Criminal Charges against violating Bidders/ Contractors /Subcontractors

If the Principal obtains knowledge of conduct of a Bidder, Contractor or Subcontractor, or of an employee or a representative or an associate of a Bidder, Contractor or Subcontractor which constitutes corruption, or if the Principal has substantive suspicion in this regard, the Principal will inform the Vigilance Office.

Section 8 -Independent External Monitor(s)

8.1 The Principal appoints competent and credible panel of Independent External Monitor (s) (IEMs) for this Integrity Pact. The task of the IEMs is to review independently and objectively, whether and to what extent the parties comply with the obligations under this Integrity Pact.

8.2 The IEMs are not subject to instructions by the representatives of the parties and performs his functions neutrally and independently. He reports to the CMD, BHEL.

8.3 The IEMs shall be provided access to all documents/ records pertaining to the Contract, for which a complaint or issue is raised before them as and when warranted. However, the documents/records/information having National Security implications and those documents which have been classified as Secret/Top Secret are not to be disclosed.

8.4 The Principal will provide to the IEMs sufficient information about all meetings among the parties related to the Contract provided such meetings could have an impact on the contractual relations between the Principal and the Contractor. The parties offer to the IEMs the option to participate in such meetings.

8.5 The advisory role of IEMs is envisaged as that of a friend, philosopher and guide. The advice of IEMs would not be legally binding and it is restricted to resolving issues raised by a Bidder regarding any aspect of the tender which allegedly restricts competition or bias towards some Bidders. At the same time, it must be understood that IEMs are not consultants to the Management. Their role is independent in nature and the advice once tendered would not be subject to review at the request of the organization.

8.6 For ensuring the desired transparency and objectivity in dealing with the complaints arising out of any tendering process or during execution of Contract, the matter should be examined by the full panel of IEMs jointly, who would look into the records, conduct an investigation, and submit their joint recommendations to the Management.

8.7 The IEMs would examine all complaints received by them and give their recommendations/ views to the CMD, BHEL at the earliest. They may also send their report directly to the CVO, in case of suspicion of serious irregularities requiring legal/ administrative action. Only in case of very serious issue having a specific, verifiable Vigilance angle, the matter should be reported directly to the Commission. IEMs will tender their advice on the complaints within 30 days.

8.8 The CMD, BHEL shall decide the compensation to be paid to the IEMs and its terms and conditions.

8.9 IEMs should examine the process integrity, they are not expected to concern themselves with fixing of responsibility of officers. Complaints alleging mala fide on the part of any officer of the Prinicpal should be looked into by the CVO of the Principal.

8.10 If the IEMs have reported to the CMD, BHEL, a substantiated suspicion of an offence under relevant Indian Penal Code / Prevention of Corruption Act, and the CMD, BHEL has not, within reasonable time, taken visible action to proceed against such offence or reported it to the Vigilance Office, the IEMs may also transmit this information directly to the Central Vigilance Commissioner, Government of India.

8.11 After award of work, the IEMs shall look into any issue relating to execution of Contract, if specifically raised before them. As an illustrative example, if a Contractor who has been awarded the Contract, during the execution of Contract, raises issue of delayed payment etc. before the IEMs, the same shall be examined by the panel of IEMs. Issues like warranty/ guarantee etc. shall be outside the purview of IEMs.

8.12 However, the IEMs may suggest systemic improvements to the management of the Principal, if considered necessary, to bring about transparency, equity and fairness in the system of procurement.

8.13 The word 'Monitor' would include both singular and plural.

Section 9 - Pact Duration

9.1 This Integrity Pact shall be operative from the date this Integrity Pact is signed by both the parties till the final completion of contract for successful Bidder, and for all other Bidders 6 months after the Contract has been awarded. Any violation of the same would entail disqualification of the bidders and exclusion from future business dealings.

9.2 If any claim is made/ lodged during currency of this Integrity Pact, the same shall be binding and continue to be valid despite the lapse of this Pact as specified above, unless it is discharged/ determined by the CMD, BHEL.

Section 10 - Other Provisions

10.1 This Integrity Pact is subject to Indian Laws and exclusive jurisdiction shall be of the competent Courts as indicated in the Tender or Contract, as the case may be.

10.2 Changes and supplements as well as termination notices need to be made in writing.

10.3 If the Bidder(s)/ Contractor(s) is a partnership or a consortium or a joint venture, this Integrity Pact shall be signed by all partners of the partnership or joint venture or all consortium members.

10.4 Should one or several provisions of this Integrity Pact turn out to be invalid, the remainder of this Integrity Pact remains valid. In this case, the parties will strive to come to an agreement to their original intentions.

10.5 Only those bidders / contractors who have entered into this Integrity Pact with the Principal would be competent to participate in the bidding. In other words, entering into this Integrity Pact would be a preliminary qualification.

10.6 In the event of any dispute between the Principal and Bidder(s)/ Contractor(s) relating to the Contract, in case, both the parties are agreeable, they may try to settle dispute through Mediation before the panel of IEMs in a time bound manner. In case, the dispute remains unresolved even after mediation by the panel of IEMs, either party may take further action as the terms & conditions of the Contract. The fees/expenses on dispute resolution through mediation shall be shared by both the parties. Further, the mediation proceedings shall be confidential in nature and the parties shall keep confidential all matters relating to the mediation proceedings including any settlement agreement arrived at between the parties as outcome of mediation. Any views expressed, suggestions, admissions or proposals etc. made by either party in the course of mediation shall not be relied upon or introduced as evidence in any further arbitral or judicial proceedings, whether or not such proceedings relate to the dispute that is the subject of mediation proceedings. Neither of the parties shall present IEMs as witness in any Alternative Dispute Resolution or judicial proceedings in respect of the dispute that was subject of mediation.

For & On behalf of the Principal
(Office Seal)

For & On behalf of the Bidder/ Contractor
(Office Seal)

Place _____
Date _____

Witness:_____
(Name & Address) _____
_____

Witness:_____
(Name & Address) _____
_____

FORMAT OF NO DEVIATION CERTIFICATE

(To be submitted in the bidder's letter head)

REF: …….. **Date**…….

BHARAT HEAVY ELECTRICALS LIMITED,
TRANSMISSION BUSINESS GROUP,
6th Floor, BHEL SADAN,
Plot No- 25, Sector- 16A, Noida,
Distt. Gautambudh Nagar, UP-201301

SUB: TENDER FOR "EXECUTION AND HANDING OVER OF SUPPLY & ETC WORKS OF 11KV DISTRIBUTION LINE AT 2X20MW RAHUGHAT HYDRO POWER PROJECT IN NEPAL".

Tender Ref.: TBSM/RAHUGHAT/11kV LINE/ETC/TENDER/25-26 DATE: 09.04.2025

Dear Sir,

With reference to above, this is to confirm that as per tender conditions, we have visited subject site before submission of our offer and noted the job content & site conditions etc.

We also confirm that we have not changed / modified the tender documents as appeared in the website and in case of observance at any stage, it shall be treated as null and void. We hereby confirm that we have not taken any deviation from tender clauses together with other references as enumerated in the above referred NIT and we hereby convey our unqualified acceptance to all terms and conditions as stipulated in the tender and NIT. In the event of observance of any deviation in any part of our offer at a later date whether implicit or explicit, the deviations shall stand null & void.

We confirm to have submitted offer strictly in accordance with tender instructions.

Thanking you,

Yours faithfully,

(Signature, date & seal of authorized representative of the bidder)

DECLARATION FOR RELATION IN BHEL

(To be typed and submitted in the Letter Head of the Company/Firm of Bidder failing which the offer of Bidder is liable to be summarily rejected)

Ref: **Date…….**

To,
Sr. DGM/TBSM
Transmission Business Group,
Bharat Heavy Electricals Limited,
6th Floor, BHEL SADAN,
Plot No. 25, Sector-16A, Noida,
Distt. – Gautam Buddh Nagar, UP-201301

Dear Sir,

Sub: Declaration for relation in BHEL

Ref: 1) NIT/Tender Specification No.: TBSM/RAHUGHAT/11kV LINE/ETC/TENDER/25-26 DATE: 09.04.2025

I/We hereby submit the following information pertaining to relation/relatives of Proprietor/ Partner(s)/Director(s) employed in BHEL

Tick (√) any one as applicable:

1. The Proprietor, Partner(s), Director(s) of our Company/Firm DO NOT have any relation or relatives employed in BHEL

OR

2. The Proprietor, Partner(s), or Director(s) of our Company / Firm HAVE relation / relatives employed in BHEL and their particulars are as below:

a)

b)

Signature of the Authorized Signatory

Note:

1) Attach separate sheet, if necessary.
2) If BHEL Management comes to know at a later date that the information furnished by the Bidder is false, BHEL reserves the right to take suitable against the Bidder/ Contractor.

DECLARATION BY AUTHORISED SIGNATORY OF BIDDER

(To be typed and submitted in the Letter Head of the Company/Firm of Bidder)

To,

Sr. DGM/TBSM
Transmission Business Group,
Bharat Heavy Electricals Limited,
6th Floor, BHEL SADAN,
Plot No. 25, Sector-16A, Noida,
Distt. – Gautam Buddh Nagar, UP-201301

Dear Sir,

Sub: Declaration by Authorized Signatory regarding Authenticity of submitted documents.

Ref: 1**) NIT/Tender Specification No: TBSM/RAHUGHAT/11kV LINE/ETC/TENDER/25-26 DATE: 09.04.2025**
2) **All other pertinent issues till date**

I/We, hereby certify that all the documents submitted by us in support of possession of "Qualifying Requirements" are true copies of the original and are fully compliant required for qualifying / applying in the bid and shall produce the original of same as and when required by Bharat Heavy Electricals Limited.

I / We hereby further confirm that no tampering is done with documents submitted in support of our qualification as bidder. I / We understand that at any stage (during bidding process or while executing the awarded works) if it is found that fake / false / forged bid qualifying /supporting documents / certificates were submitted, it would lead to summarily rejection of our bid / termination of contract. BHEL shall be at liberty to initiate other appropriate actions as per the terms of the Bid / Contract and other extant policies of Bharat Heavy Electricals Limited.

Yours faithfully,

(Signature, Date & Seal of Authorized
Signatory of the Bidder)

Date:

Place

FORMATS FOR EPAYMENTS

To,

Sr.DGM (Finance)
Transmission Business Group
BHEL, TBG Finance,
Plot no. - 25, Sector - 16A
Noida - 201301; U.P.

Subject: E-Payments vide RTGS/NEFT

I/We request and authorise you to effect Epayment vide any of the above two modes to my/our bank account as per the details given below:

Vendor Name	:
Title/Name of Account in the bank	:
Account Type(Saving /current)	:
Bank Account Number	☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐
Name & address of Bank	
Bank /Branch contact person's name	:
Bank /Branch Tele Numbers with STD code	:
Bank Branch MICR code	☐☐☐☐☐☐☐☐☐
	(please enclose a copy of a cheque. This cheque should not be a payable at par cheque)
Bank Branch RTGS IFSC code	☐☐☐☐☐☐☐☐☐☐☐
Bank Branch NEFT IFSC code	☐☐☐☐☐☐☐☐☐☐☐
	(you can obtain this from branch where you have your account)
Your Email address	: **(not more than 20 character)**
Name of the Authorised Signatory	: (Please mention here name of person from your organization signing this letter.)
Contact Person's name	: (please mention here the name of a person in your company/organization)

I/We confirm that information provided above is correct & any consequences due to any mistake in above will be borne by us.

Thanking you

For
(Autorised Signatory)

We confirm that we are enabled for receiving RTGS/NEFT credits and we further confirm that the account number of (Please mention here name of the account holder), the signature of the authorised signatory and the MICR and IFSC Codes of our branch mentioned above are correct.

Bank's Verification
(Manager's/Officers signature under
bank Stamp)

Note:- Please attach cancelled original Cheque leaf.